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Science and Technology for Human Development – The Ambiguous Future and the Christian Hope

Selected Preparatory Papers for the 1974 World Conference in Bucharest, Romania

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These papers are circulated for the information of participants in the ecumenical enquiry on "The Future of Man and Society in a World of Science-Based Technology". Comments are welcome.

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INTRODUCTION

The five-year World Council of Churches' inquiry on *The Future of Man and Society in a World of Science-Based Technology,* begun in 1969, will conclude in 1974 with a world conference in Bucharest, Romania, 24 June – 2 July. The theme is: "Science and Technology for Human Development – The Ambiguous Future and the Christian Hope". Taking part will be Christians from many branches of science and technology and from public life, together with theologians and church leaders.

The task of the Bucharest meeting is to draw together the ideas and recommendations from a whole series of national, regional and international ecumenical meetings which have been exploring issues arising from the concern for our future in a technological world. The conference must also evaluate a considerable number of special studies and reports prepared in the course of the inquiry, and the reactions to them. Many of these have been published in *Anticipation.*

This issue presents a number of preparatory papers which have been compiled as part of the background reading for the conference. Since they summarize the results which have so far been reached in the course of the study they are meant to provide basic input to the working groups which will meet on four main sub-themes:

I. The Significance for the Future of Pressures of Technology and Population on Environment and of Natural Limits to Growth.

II. Meaning of Quality of Life and the Human Implications of Further Technological and Related Sociological Change (incl. sub-group on Human Settlements)

III. Development and World Social Justice: The Search for Alternative Models, Ideologies and Utopias

IV. The Theological Understanding of Man and Non-Human Nature in a Technological Era

The papers contributed to this issue of *Anticipation* correspond to these four working groups:

I. "To Grow or not to Grow: Is that the Question?" by Prof. Hans Linnemann and John Garbutt, both from the Free University of Amsterdam;

"Ethics of Natural Resource Use" by Dr. John Francis, Director of the 'Society, Religion and Technology Project' of the Church of Scotland;

II. "Quality of Life and Technological Options: The African Perspective" by Dr. Benjamin C.E. Nwosu, Senior Lecturer of Physics, University of Nigeria;

"Values, Life Styles and the Future of the Technological Society" by Prof. C.H. Waddington, Animal Geneticist of the University of Edinburgh;

III. "Science, Ideology and Society in Latin America" by Prof. Amilcar Herrera, Director of a study on a Latin American world model in response to the "Limits to Growth" report of the Club of Rome;

IV. "The Impact of Science and Technology on the Theological Understanding of Social Justice" by Prof. Roger Shinn from the Union Theological Seminary, New York.

Most of the time of the Bucharest Conference will be devoted to discussions in the working groups. Although the number of plenary sessions is limited we look forward to a series of plenary presentations which might well stimulate the debate within the groups. For those who will not participate in the conference a brief introduction of the main topics and speakers is given here:

1. "Technology and the Future of Compassion", Paper by Prof. Lynn White, Jr. (U.S.A.)

   "Cultural Values and the Future of Technology", Paper by Prof. E. Mveng (Cameroon)

   Comments by
   Bishop Albert Klein (Romania)
   Prof. Philip Shen (Hong Kong)
   Prof. Langdon Gilkey (U.S.A.)

2. "Technological Development and the Future of Man in a Socialist Society", Dr. Mircea Malita, Minister and Counsellor of the President of the Socialist Republic of Romania.

3. "Ethical Guidelines and Social Options After the Limits to Growth Debate",

   Introduced by
   Prof. Kenneth Boulding (U.S.A.),
   Prof. S.L. Parmar (India)
   and Prof. Georg Borgstrøm (Sweden)

   Comments by
   Prof. Hans Linnemann (Netherlands),
   Prof. Sam Aluko (Nigeria),
   and Dr. Marwan Iskandar (Lebanon)

4. "Human Prospects in Societies Shaped by Science-Based Technology".

   Panel Discussion:
   Dr. Magnus Pyke (U.K.)
   Dr. Margaret Mead (U.S.A.)
   Dr. Erhard Eppler (Federal Republic of Germany)

5. "The Power of Science and Technology – and International Distributive Justice" (The Institutional, Cultural and Political Issues)

   Presented by
   Prof. Amilcar Herrera (Argentina)
   Prof. Peter Odell (U.K.)
   Prof. Nathan Shamuyarira (Tanzania)

6. "Helping Science and Technology Serve Human Goals – Some Case Studies Based on Local, or Regional Action Projects"

   Prof. Jun Ui (Japan)
   Dr. John Francis (Scotland)
   Dr. Warwick Kerr (Brazil)

All this constitutes a formidable assignment for the 130 participants expected at Bucharest. Of special interest is the fact that this meeting is the first of its kind in Romania, a socialist and an Orthodox country. The sessions of the conference will be held in the Orthodox Theological Institute in Bucharest, where the participants will be the guests of Patriarch Justinian of the Romanian Orthodox Church.

The findings of the Bucharest meeting will be reported to the Central Committee, August 1974, and through it to member churches and interested groups. Between September 1974 and July 1975 this material will be made the basis of further reflection, discussion and action in the WCC member churches and with interested groups and study centres. It will be up to the WCC Assembly in Jakarta in 1975 to decide how the ecumenical concern with these issues might be continued or followed up.

To understand the significance of the Bucharest Conference, it is necessary to recall the impulses given to ecumenical social thought beginning with the concept of the Responsible Society in the Amsterdam Assembly (1948), and substantially extended by the World Conference on Church and Society in Geneva, 1966. The 1966 Conference had as its key words: development, revolution and the hope for a new society. There was at that time confidence that the technological revolution could readily be harnessed to the needs of development. The emphasis was on urgent economic growth with justice for all.

In 1968, the WCC Assembly at Uppsala recommended a programme of study emphasizing the contribution of scientists and technologists. The first consequence of this new inquiry was to call attention to the manifold possibilities for man's further growth and for change through technology. This optimism was later tempered by growing awareness of the limitations of science and technology; the threat to personal and group identity posed by the further rapid extension of technological control and manipulation of life; and by a new consciousness of the possible exhaustion of certain natural resources and the effects of the rapid increase of population. Thus the future could no longer be automatically considered as synonymous with hope. There was increasing recognition that humanity has to control growth if it is to survive, and that this involves a new understanding of man's future.

The ecumenical inquiry on the future of man and society has therefore pushed ecumenical thought into new directions: (1) an evaluation and interpretation, in ethical perspective, of the present debate on the limits to economic growth with the implications for the right use of the environment and resources; (2) study of the consequences for social justice of this new situation, and the new obligations placed on developed countries as they search for alternative models to a high-consumption society, and on the developing countries as they search for freedom from poverty and for economic self-reliance; (3) the meaning of new scientific and technological discoveries for the quality of life, and the need to discover new criteria for measuring welfare and happiness (especially in relation to the crisis of urban civilization); (4) the need for a new theological critique of scientific rationality, and a new understanding of Christian doctrine concerning the relation between man and nature before God.

No church or society, nor any of the great social ideologies which have influenced contemporary society, are as yet prepared to cope with the consequences of the immense developments in science and technology, the effects of which are being experienced by peoples everywhere. As an ecumenical working group on Science and Theology, meeting in Zurich in June 1973, said in its report, this is not a question of putting blame on anyone (see *Anticipation,* No. 16, March 1974). No one could have foreseen, nor yet foresees, the implications of the scientific-technological revolutions confronting us.

The Bucharest Conference will not therefore seek to predict the future or even expect to reach agreement on what technologies would be ecologically wisest. As the Working Group in Zurich declared: "We do not know from Christian faith what forms of technology will be viable in the future, but we do know thanks to the liberation that is in Christ, that technology must not be permitted to serve oppression (...) we have a hope for the future, grounded in our trust in the divine faithfulness from generation to generation that gives us the courage to risk concrete action programmes which today seem to us responsible, even though only God knows what will become of them in the end."

It is the hope of the Working Committee and the staff of Church and Society who have nurtured this ecumenical inquiry, that the Bucharest conference will indicate the most preferable options, make clear the Christian bases of our judgments and stimulate new proposals for action by the churches.

Paul Abrecht

TO GROW OR NOT TO GROW: IS THAT THE QUESTION?

by John Garbutt and Hans Linnemann

A. THE LIMITS-TO-GROWTH DEBATE.

1. Its origin.

New ideas are hardly ever "new" in an absolute sense; looking backwards, it is usually possible to see them developing and emerging from earlier thinking. This also applies with respect to the idea that these are "limits to growth" – limits to the growth of population, to the growth of material production, to the growth of energy consumption. Nevertheless, the publications of the Club of Rome – and in particular the report to the Club written by the M.I.T. team headed by Professor Dennis Meadows – have for the first time in history opened the eyes of large numbers of people (especially in the highly industrialized countries) to the finiteness of a good many of the earth's resources, and to the possibility of collision with one of the boundaries.

The Meadows team constructed a dynamic model – partly based on an earlier model of Professor Jay Forrester – of 121 equations describing the assumed interrelations between five variables of crucial significance: population size, food production, industrial production, pollution, and the use of nonrenewable natural resources. The coefficients of these equations, and the values of stocks of resources and levels of activity have been chosen in such a way that the model gives a simplified but reliable picture, according to the M.I.T. team, of the reality of today's world society. As it is a dynamic model, it also shows how the various magnitudes will develop over time if the pattern of behaviour of human society were not to change.

The prognoses of the future resulting from the model are very alarming. Continuation of exponential growth (i.e. growth with a constant annual percentage) of population and industrial production inevitably leads to complete exhaustion of mineral resources (ores, petroleum), or to food shortage because of erosion of arable land, or to excessive and therefore fatal pollution. The conclusion of the Meadows team are: [1]

1. If the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity.

2. It is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has an equal opportunity to realize his individual human potential.

3. If the world's people decide to strive for this second outcome rather than the first, the sooner they begin working to attain it, the greater will be their chances of success.

2. The first comments.

Publication of the M.I.T. study, in spring 1972, caused a great deal of discussion, particularly in the most densely populated and industrialized regions of the world. [2] General criticisms of the report, and of the model underlying it, may be summarized as follows:

[1] *The Limits to Growth* – D.H. Meadows, D.L. Meadows, J. Randers, W.W. Behrens. Potomac Associates 1972 – pp. 23 and 24.

[2] The Working Committee of Church and Society received a preview in June 1971 at Nemi, Italy, when Jorgen Randers read a paper "The Carrying Capacity of our Global Environment – A look at the ethical alternatives", reprinted in *Anticipation* no. 8.

a) many of the assumed relationships between variables lack a solid empirical base, and mistakes have been made in the estimation of important coefficients;

b) the model is too aggregated (e.g. dealing with world totals and world averages only), and does not take into account the huge differences between regions and individual countries; similarly, variables such as "industrial production" and "pollution" would need disaggregation;

c) the role of technological progress is underestimated;

d) human reactions and processes of social change have been inadequately incorporated into the model;

e) the study does not really provide a base for policy action.

To be fair, it should be emphasized that the report itself recognizes some of these shortcomings; moreover, it would seem to be inevitable that mistakes are made in a study breaking new ground. In spite of the fact that the numerical results of the M.I.T. report cannot be given much credit, many of those who studied the report have drawn attention to the following positive points:

a) most of the issues discussed in the report are indeed highly relevant and have not had adequate attention so far: e.g. the notion of living on a planet of finite dimensions; the relation between human activities and ecology;

b) due to the rather long time delays in many relevant processes, there is an urgent need to study the (very) long-term development possibilities for society and economy much more carefully than has been done up till now;

c) the need to analyze demographic, economic, social, ecological, and still other processes in their interrelations and interactions has been underlined once more; partial analysis and partial problem-solving will not do.

3. The debate continues.

Of course, the debate about the limits to growth is still going on. In this debate, new and better information has been presented, and new dimensions have been added. The Club of Rome has encouraged further studies, most of them still under way. Also, the Club has emphasized that the M.I.T. study had to concentrate on the physical limits only, while perhaps more immediate limits may exist due to the inadequacy of political, social and cultural institutions or even due to the constraints on mental and emotional development of man himself. However, most of the discussion has centred around the physical limits to economic growth. The implications of living in a closed system (except for the inflow of solar energy) are being investigated, and a lot of work on quantifying limits (to resources, energy, absorption of pollution, food production) is being undertaken. Unfortunately, the debate sometimes has led to a very polarized "black-and-white" situation concerning growth and no-growth as being practical alternatives. More promising are the discussions about such concepts as "equilibrium society" and "qualitative growth" and "steady-state economy" – though they remain vague and sometimes confusing.

There is an obvious need for more clarification and understanding of the nature and determinants of economic growth. This is true for both poor and rich societies, although the problems are not all the same. An attempt at a further clarification of the issues at stake in the growth/no-growth debate is made in the next section.

B. QUALITATIVE GROWTH: TOWARDS RESTATING THE PROBLEM OF ECONOMIC GROWTH IN A CHANGING CONTEXT.

1. What has happened to growth? The pitfalls of undifferentiated thinking.

Words can be seen as the currency with which we exchange our ideas and experiences. This currency too is susceptible to devaluation. Can 'the limits to growth' mean that growth in all the fulness of its meaning must be stopped? Of course not. 'Growth' is a word rich in meaning, inseparable from basic elements of life itself. We devalue it when we indiscriminately tie it to the production of goods; when we use it as a shorthand term for the increase in one aspect of things temporarily associated with life.

'Growth' has slipped into shorthand for 'economic growth' which itself has, again wrongly, come to imply 'growth' in production of material goods; this, for many people in industrialized societies has in turn come to be connected with the negative consequences of the way the goods are produced.

This is not to imply that there are no problems concerned with the patterns in which economic growth is organized, its side effects and the social institutions in which it takes place. On the contrary. In order though, to state the problem properly and adequately we need to attempt clarification of the concept itself; then the range of criticisms of it need to be sorted out as to what specific aspect is the object of a critique. All critiques will not relate to all the aspects of economic growth – it would be convenient if such an omnibus approach could be found, for those who desire a few watertight categories in a black and white scheme of things. But it would not help. It can be argued that this single-eyed thinking contributed to the problems we are beset with now. This is true, though it also may be a factor in the success of technology and economics in reducing scarcities. But to try to state the problems in the new situation with such a single-eyed vision of things would take us out of the proverbial frying pan into the fire.

Thinking in aggregates, thinking globally, thinking in the very long term, they all have an important and increasing role to play. But it must be recognized that the making and carrying out of policies in a world with vast differences of resource endowments, production possibilities, and consumption needs, also requires much differentiated thinking – thinking of next steps, in the varieties of situations which exist. It requires thinking with more nuances than that which approximates a nation's well being, with its Gross National Product, or which classifies countries as developed and under-developed, dependent and independent; or which says we must have growth or no-growth; or even which says that environmental deterioration is a concern only of certain countries.

2. What is Economic Growth?

First of all, a means, not an end.

According to present-day economic theory, economic growth takes place when scarcity is reduced; i.e. when human needs that can be satisfied through production and consumption can be met more adequately. At its simplest this is what economic growth is for – the reduction of scarcity in goods or in the supply of means to obtain these goods.

Because it concentrates on reducing scarcities, it obviously cannot be an end in itself, for scarcity, when satisfied, no longer pertains, and is in any case a relative concept.

Thus economic growth is a means to reach certain social goals. These goals have been termed prosperity, which is a psychical and not a physical concept. Prosperity concerns satisfaction of needs. Prosperity is in turn not equivalent to the material substructure which forms only one of the conditions for human well-being. Economic growth is a means to achieve the goal of prosperity, which itself is only a necessary but not sufficient condition for human welfare. Economic growth provides the means, the tools, to reduce material scarcities and thus satisfy part of human needs – nothing more.

What is Gross National Product?

Economic growth, in order to be controlled, to be planned, and in the end to be increased, required a measurement. This has come to be the Gross National Product. This is the total value of the output of goods and services (including government services), measured in monetary units; strictly speaking goods and services used in the production process itself are first deducted. "Goods" includes consumption goods, machines to produce goods (capital goods) and increases in the stocks of various goods.

It is a dangerous and unfortunately widespread misunderstanding that economic growth is only 'real' when more physical goods are produced (either capital or consumption goods). This is not true; economic growth also occurs when more services (like e.g. adult education) are produced, or when goods of better quality are made.

The use of GNP as yardstick for economic growth has come about because in a situation of obvious scarcity, increased production of goods is closely linked to increased welfare, and thus the level in the non-material concept could be approximated to the level in the material one.

However, clearly not all scarcities of things which are necessary to human well-being can be met through the production process. There are many goods (fresh air, clean water for example) which cannot be produced. But if they satisfy needs, and are scarce, then they too should be incorporated in some way or other in the measurement of economic growth. To date they have not been considered to belong to the economic system because they do not appear in any market, and therefore any reduction in their scarcity cannot be counted in the Gross National Product. They have no price as yet, and some are not possessed by an individual, but commonly owned.

More will have to be said about these aspects of scarcity and economic growth in the next section. In the meantime it should be recognized that, for all practical purposes, politicians, economists, and the public at large simply equate economic growth with growth in GNP. Moreover, virtually all governments and by far the majority of people behave as if growth in GNP means increased prosperity. This simplistic way of looking at things economically has been attacked by the no-growth proponents – often inspired by the criticism of present-day behaviour as expressed in the Meadows report.

The Limits to Growth – A Critique from Outside Economics.

The Meadows critique of economic growth is that the pattern of exponential increase (when the rate of increase is proportional to the existing stock) of capital and population is incompatible with the supply of raw materials and biological limits. The critique is based on a perspective of the future, i.e. prognosis of the collision if present patterns were to continue unchanged into the future. It applies not globally, but to highly industrialized economies. Its global prognoses could have relevance only if it is assumed (as the Meadows study does) that all countries model their patterns and methods of growth on the industrialized ones.

In the next section, criticisms of economic growth from other perspectives will be analysed in somewhat greater depth. Section 4 deals with the changing context of economic growth, as resulting from increased understanding of physical and ecological constraints. Finally, on the basis of this discussion section 5 tries to restate the issue of growth or no-growth.

3. Critiques of Economic Growth from other perspectives.

3.1. FROM WITHIN ECONOMICS ITSELF – A CLOSER LOOK AT THE CONCEPT OF ECONOMIC GROWTH AND GNP.

In actual practice, economic growth is identified with growth in gross national product or national income. Economic theory has recognized, however, that the GNP as defined by the economic statisticians is only a crude measure for the level of economic development or well-being of a country. Some of the shortcomings of the GNP yardstick that have been recognized (often for a long time already) should be mentioned here briefly.

a) Problems of price, of quality, and of distribution; no distinction between needs and wants.

In order to bring the tremendous variety of goods and services produced to a common denominator (as required for addition), their quantities are converted into values through multiplying them by prices. Price formation takes place on a market, but the functioning of the market system may be widely different for different products and different places (countries). [3] In a market only those needs are registered that can express themselves in effective (monetary) demand; if incomes are highly unequally distributed, basic needs of many people may go unfulfilled while extravagant wants of a few rich people are readily satisfied. [4] Also, modern advertising and sales techniques are sometimes able to create "needs", the satisfaction of which hardly contributes to material well-being. Thus, the GNP measure is criticized because of the institutional shortcomings of the price system, the weak reflection of quality and quality changes, the incorporation of artificial "needs", and – perhaps most of all – the complete neglect of the distribution of goods over the population.

b) GNP and collective goods.

Not all goods and services produced can be marketed. In particular, collective or public goods (satisfying societal rather than individual needs) cannot be sold: public safety, local and national administration, etc. This problem is solved by including them in the GNP measure at the cost at which they are produced (e.g. salaries of public servants). However, part of these collective goods are merely offsetting the negative effects of private production and consumption behaviour: ambulances and hospital capacity working for the victims of traffic accidents do not really increase national well-being but just compensate (in part only!) the losses created by failures of the transport system. One may have similar doubts about the assumed contribution to national well-being of increased defense spending.

c) Human costs in the production process.

A major shortcoming of the GNP measure is that it gives little or no consideration to the human disutilities involved in the production process. Participation in the production process may be a desirable thing in itself – up to a certain point. Leisure and "free time" are also (again, up to a point) valued positively, not only in order to recover from productive effort but also in their own right. Leisure is not counted in GNP; perhaps more important, also the disutility involved in work and working conditions (danger, stress, alienation) are not taken into account.

3.2. THE "DISECONOMIES" OF GROWTH.

When a good is produced, a scarcity may be reduced. But concurrently there occur many effects in other connected systems. These effects are by-products, in the sense that they were not the defined aim of production. They may occur in the extraction of the factors of production, materials, energy or the human labour applied. These are effects which the input systems must bear. They may also occur in dealing with the residuals of the process, absorbing the waste energy or materials.

The diseconomies are the negative effects of how the good is produced – the technology used, the social organization demanded by the production technique, the way the wastes are ejected for absorption, the destruction of beautiful countryside for mining or factory sites, the organization for transportation of goods and materials for example.

Although the word 'diseconomies' is an awkward word itself, it expresses well what is meant in these critiques. It identifies the goods, both produced and free, individually or commonly owned, which are becoming scarce through the too narrow identification of economic growth with growth in material production. In order to produce more goods whose scarcity has already been greatly reduced, other scarcities are induced which cannot be satisfied by production growth.

More accurately it should be called the study of the negative effects on well-being that are not taken into account by the economic actor (i.e. producer, consumer, government).

[3] Because of a lack of (technological) knowledge or a lack of organisation at the side of the consumers, quality differences often are inadequately reflected in price differences; for marketing reasons, quality may be kept at a lower level than technologically feasible.

[4] Can the line between needs and wants be defined? It seems to slide upwards as more and more needs are satisfied.

The further complication in this state of affairs is that the social institutions of production and distribution are often so ordered that the diseconomies are felt by groups whose very needs are not even satisfied by the growth in production itself. Thus a dual scarcity exists, while for other sections of society consumption surpasses reasonable satisfaction of need, with the resulting diseconomies, at least for a time, remaining unobserved, either geographically or socially distant. This occurs in many cities, as the richer groups gradually flee the crowded centres; it is observed nationally comparing different regions, and it has its all too clear expression in a global sense. But this is properly the subject of justice – a concept appearing more ubiquitous and basic as our debates on economic growth progress.

The above points may suffice to show that increase in production need not and often does not imply economic growth seen as reduction in scarcities for the purpose of improving human welfare. One can readily argue that increased product may lead to negative economic growth. The converse is well possible too, that real economic growth may imply a constant or even decreasing GNP, in some circumstances. To make this clear to people and institutions who equate economic growth with increase in produced goods will be a colossal task.

3.3. "GROWTH IS NOT DEVELOPMENT": THE CRITIQUES FROM THE THIRD WORLD.

In the developing countries large numbers of the world's people suffer scarcities in goods necessary for the satisfaction of their basic needs. Poverty, being the scarcity of those elements which make up the necessary minimum level of living, ought therefore to be the proper subject of economic growth.

The disconcerting evidence in a number of countries, that both absolute and relative poverty are increasing while gross production also increases, is the starting point for these critiques from the Third World.

Production growth can never itself bring about distributive justice.

This is clearly said in two quotations from the Kuala Lumpur Conference (April 1973).

> *"One assumption of Asian development strategies was that poverty would be eliminated through high growth rate: if you take care of the GNP, this will take care of poverty.*
> *It is now recognized that on the contrary poverty must be attacked directly by creating new political and social and economic structures so that the benefits of development accrue directly to the masses. There must be economic growth, but growth alone is not enough. Social development and social justice needs to be given priority. This requires a pattern of development which makes growth and social justice complementary to each other. Development should concentrate on those sectors of the economy which directly help the poor".* [5]

Professor Parmar deepens this:

> *"From our standpoint only such increases in GNP can be indicative of growth as result from a massive increase in production for those below the poverty line. In other words our production priorities must be determined in terms of social needs calculated on the basis of desirable minima. Since our resources are limited it will be necessary to impose a national maximum in consumption patterns in order to release resources for production of essentials. Discussions about welfare and social justice tend to talk only about a desirable minimum but overlook the equally important need for fixing a permissible maximum. Unless the two are kept together we may have dole for the poor but not social justice. Growth of GNP cannot by itself ensure availability of goods and services to the masses. It is necessary to build institutions for this purpose. Higher rates of growth have so far given a fresh lease of life to non-egalitarian institutions which obstruct development".* [6]

Similar words came from the African Conference held in Ghana in March 1972. In the paper of Dr. Mutiso we read:

[5] Kuala Lumpur Conference, in *Anticipation* no. 14, p. 30.
[6] Prof. S.L. Parmar, "The Environment and Growth Debate in Asian Perspective", *Anticipation* no. 14, p. 4.

"Desirable economic growth is that which is reflected in actual improvement in the education, health, and living conditions of the majority of our people. The economic growth which has been peddled to us from the West and which has been accepted by the asomi *has produced little social justice for the majority of our people, since production and distribution have never been oriented to the* non-asomi. *This has been the failure of the African revolution, and until we Africans think seriously about our future we shall remain colonized, although we have juridical independence."*[7] (Dr. Mutiso distinguishes the "asomi" early in his paper as those who, early in the colonial order, identified themselves with the colonial rulers and acquired a new status, becoming the "book people". They received more economic benefits, education etc. and "hence so-called modern Africa was ultimately recruited from the 'asomi' strata").

4. The changing context of economic growth.

Adding to our awareness of the diseconomies of production growth and of the disturbing contradictions of deepening poverty and rising GNP in the Third world, there comes now the realization of biological limits, and of resource limits to production growth. In combination these are signs that the problem of economic growth must be redefined, and that the context in which this must be done is changing its shape. This means that new relations between areas of thought, previously separated, become important. As the relations between different disciplines multiply, the traditional limits become blurred, and hostilities and misunderstandings are bound initially to arise. On the boundaries, tensions can often be high and communication difficult or forceful.

One major misunderstanding of the place of economic science in these changes is, that it is a static science with a given set of laws. It is as if some people imagine that economists created economic growth, set it equal to growth in GNP, and so it will remain for all time. This is not true. Economics has responded in its past to a number of changes in societies' conceptions of what was of value, what was scarce and what abundant. There are no reasons why it cannot respond again as it becomes clearer where the values and new scarcities lie.

4.1. MEETING THE ECOLOGICAL MODEL OF REALITY: THE EARTH AS A CLOSED SYSTEM.

Production and consumption, and to a lesser extent distribution, have had the main attention of economists to date. Of these three, production has even had the primary place. This was because, at the previous levels of activity, standard of living and population of the earth, inputs of matter and stored energy (e.g. fossil fuels) could be considered effectively limitless. Attention was focussed on reducing more immediate scarcities in skilled d labour and in the machines to produce goods. This is no longer so. Physical limits to the availability of arable land, of mineral ores of reasonable quality, and of fossil fuels exist, and may be not so remote as previously thought. This is termed closure with respect to material input to the economic process.

Closure with respect to outputs.

On the other side of the production-consumption cycle is disposal of residuals (or by-products) of production, and of wastes in consumption. It is water, air or land which must eventually deal with these residuals, some can be easily absorbed, others cause disturbance to biological cycles of varying but often unknown seriousness. For a long time in human history, the absorptive capacity of the biosphere could be considered limitless; the system of production-consumption thus was open with respect to outputs also. The changed context of the economic system is found in the knowledge that the outputs of production and consumption can become inputs which derange other (biological) systems, whose outputs are in turn, important for all species and for man himself – our air, water and food. Thus, the capacity for absorbing residuals is in certain cases becoming a scarce good, and therefore enters the economic system. The economic system is thus moving from being open to closed also with respect to outputs.

[7] West African Conf. on Science, Technology, and the Future of Man and Society – March 1972, Ghana; *The Ecumenical Review*, July 1972: "Tools are for people: Towards an Africanised Technology", Dr. G.C. Mutiso – p. 39.

4.2. SOME IMPLICATIONS OF THE CLOSED SYSTEM.

The nature of the inputs is such that if they become scarce, their scarcity can only be reduced by conservation or by substitution. There are opportunities for recycling (saving outputs to become inputs to the same cycle) but this costs energy – an input that itself is likely to become more scarce. Obviously, conservation can also be achieved through refraining from producing and consuming. Substitution of exhaustible materials of increasing scarcity may take two forms: either they are replaced by exhaustibles of greater abundancy (which is not really a solution of the problem but rather "buying time" only), or they are replaced by non-exhaustibles – i.e. by materials produced in the process of photosynthesis, or by solar energy.

The transition from open to closed for outputs or residuals can be viewed in two ways. The absorptive capacity of the biosphere can be considered a limited good which is becoming scarce and therefore must enter the economic system. This view translates itself often into the principle "the polluter pays", namely the price for the used-up absorptive capacity. The price is paid to the government, in the form of a pollution tax; the tax receipts may be used to restore the environmental damage as much as possible. If full reparation of the damage is not possible, the price should be set higher. From another point of view the biological quality of earth, water, air and other living systems can be seen as something that must be maintained at a level described as "healthy" (just as that is the objective of human medicine). Residuals identified as "health dangers" should not enter the biosphere at all, and their emission will have to be prohibited by law.

4.3. INCORPORATING UNCERTAINTY.

The most we can say of the state of transition from open to closed, in the economic system, is that the degree of closure is at present uncertain. That it was, by and large, legitimate to consider it an open system we know (although local calamities due to ecological sins have occurred since ancient times). That it is ultimately a closed system we know also. Today the operative word is uncertainty as regards both the rate at which closure will become of over-riding importance, and the implications for the economic system of being closed. Economic decisions should be made in a method which accepts these uncertainties, expressing the risks which lie in various choices.[8] The new direction in which we may need to go will become clearer as our certainty of the limits and of their relevance increases. During the time in which we are uncertain, the choice of speed in our present direction should take well into account the delays of our social institutions in adapting to a change in course which may later be necessary.

Energy.

Energy has a special place in the cycle of physical production and consumption, and a bearing on the alternatives available for changing production patterns. A closed system must obey the physical law of entropy. Entropy can be seen as a measure of the unavailable energy in a system where energy does work. Entropy in a closed system increases. Once a piece of coal is burned its free energy cannot be recovered – it remains somewhere but is unavailable. Energy cannot be recycled. All this is true for all forms of energy generated and used within the closed system.

In a physical sense, the world is a closed system – except for the inflow of solar energy and its corresponding outflow. Thus, the use of solar energy has in principle an advantage over all other sources of energy as these are part of the closed system. Unless this solar source can be tapped much more widely and efficiently than at present, it would seem to be a wise policy to economize (particularly, of course, in the affluent societies) in the use of energy. This implies that production and consumption patterns minimizing the use of energy will have to be preferred to energy-intensive processes and ways of life.

4.4. THE CLOSED SYSTEM AND THE "STEADY-STATE" IN MATERIAL PRODUCTION.

In the rules of the closed physical system, the level of production (or the rate at which resources are transformed into goods) cannot be indefinitely increased. The economists Boulding and Daly have talked of the 'steady state

[8] For some useful discussion on this, see the report of the Cardiff Conference of Church and Society, *Anticipation* no. 13, p. 10. "Comparing the risks of alternative approaches" and "Assessing the Social Consequences".

economy'; the *Limits to Growth* talked about the 'equilibrium state'; Tinbergen and others have made reference to qualitative growth and to zero quantitative growth. Basically, all these are expressing that the rate of material production must eventually come under a control which maintains it at a constant level, or within a certain range. What will determine the range in which this rate of production must be regulated?

Three things play a part:

1. the rate at which scarcities appear in the input resources (or the rate of exhaustion of resources);

2. the rate at which the biosphere can accept outputs (or the rate at which biological measures of its health are diminishing);

3. the minimum level of material goods required for eradicating poverty and providing a base of prosperity for all people. Accounting for the rate of population growth, this allows us to estimate a minimum desirable bound to total production needed to meet the provisions of the 'Charter of Human Rights' in its reference to physical needs for life. [9]

The theoretical considerations in section 4.3., without this third lower bound, would imply a policy of maintaining the material production rate, steady at a level that can be sustained over the long term, determined probably by the rate at which the worlds' renewable resources restore themselves. In essence this would mean keeping our energy budget as close as possible to what the sun inexhaustibly provides (and perhaps using this energy close to where it is received). Such an "equilibrium" may or may not be feasible, it may or may not be desirable, or conform with other than an ecological view of man's place and purpose on earth. We have to conclude that we just do not scientifically have the means to answer these doubts at present; we do not properly know the right questions.

Whatever idea of steady-state is discussed it will have to account for the lower bound. The path to a steady production rate, in a range defined by these three bounds, is of more importance for us today than debating the finer points of a far distant state of affairs, on presently inadequate information. This is not a denial of the importance of these concepts for the future. [10]

4.5. THE CLOSED SYSTEM AND DISTRIBUTION.

It is difficult, if not impossible, to imagine, however, how any human ecological equilibrium could be reached on the earth without passing through the way of distributive justice, as one of the necessary pre-conditions for equilibrium. In a closed system the distribution of both the input resources and the production becomes a fundamental issue. Where there are competing parties, what one takes the other cannot have – that is an axiom of the closed system. Therefore the need for an adequate theory of distributive justice for resources and production (or income) is inescapable. This must take into account the demands of people living now, and at the same time conserve adequate resources for future generations. The role of distributive justice as a natural and positive force in reducing population growth should not be underestimated, as it tends to have been. [11] When we consider too the political means which would be needed for inducing slower rates of material growth in the industrialized countries, a greater measure of internal social justice seems a necessary pre-condition.

5. A restatement of the problem of economic growth.

The above discussion was necessary in order to help us to see what aspects associated with the concept 'economic growth' need correction, and the way in which one can begin to renew it.

[9] See the *International Covenants on Human Rights* – December 1966, especially articles 7 and 11 on food and housing, 12 on health and 13 on education.

[10] Only very rudimentary models of aspects of "global systems" have ever been made; e.g. the biosphere is only beginning to be charted. Equilibrium of a whole system can exist if, and only if, each part (open sub-system) is in equilibrium, in the conditions provided by the other parts to which it relates. "Global equilibrium" would have meaning only when specified in terms of the conditions of equilibrium of the parts (e.g. countries or regions) and their inter-relations, defining the different states of equilibrium and how they are reached.

[11] "Population Policy, Social Justice and the Quality of Life" – *Study Encounter,* Vol. IX, No. 4, 1973, p. 4-6. Esp. p. 5 "Recent studies suggest that programmes of social justice in particular localities may lead to a decline in birth-rates, while birth-rates remain high where growth is not governed by social justice".

5.1. WHAT CAN WE DO WITH THE GNP MEASURE?

One thing is clear for both industrial and under-developed situations: economic growth must be released from its virtual identification with growth in the volume of material production, and from GNP as a measure standing alone. It must be restored to its rightful place as a means of reducing scarcities that limit well-being. To do this, theoretically three alternatives are open. One is to replace the measuring rod, GNP, with a new one gauged in units which incorporate what was missed in GNP. A recent attempt at constructing an index of economic welfare is that of W. Nordhaus and J. Tobin, who developed "a primitive and experimental measure of economic welfare (MEW)" oriented to consumption rather than to production. [12] Similar attempts are being made elsewhere.

The second alternative is to keep GNP as the central indicator, and convince the public and those in the political process that it should not be maximized, but held constant, or reduced, or whatever would pertain to increasing welfare and to real economic growth relating to new scarcities. This re-education would be of immense difficulty as "the imperative of increasing material production" has achieved the status of an ideology among many people, who quite erroneously expect "zero production growth" to mean stagnations, and "a fall in GNP" certain disaster.

The third is a reasonable combination, which is to develop, alongside GNP, other relevant indicators to measure the economic growth in areas and aspects of scarcity not covered by the GNP definition. What then happens to the GNP indicator, and what significance we give to its rising or falling, will be determined also by how the other indicators behave.

In addition to indicators of the changes in scarcity in what were previously considered to be "free goods" (the gifts of nature), one could think of such indices as the social indicators being developed by the OECD [13] and the level of living index proposed by UNRISD (U.N. Research Institute for Social Development).

The third alternative is doubtless the most preferable. GNP gives information on many happenings of economic importance, and is a relatively easy index to construct. The idea of constructing a new single index to replace it has been admitted by some social theorists as hopeless. New indicators must be constructed in a differentiated way, in each economic and social context, for measuring rods of improvements in each society. GNP must be, in turn, "de-mythologized".

5.2. THE IDEA OF QUALITATIVE GROWTH.

In restating the problem, the concept of Qualitative Growth is important. The Cardiff Conference put the issue this way:

> *"The option before us is not between growth and no-growth. Our task is not even merely to define an optimum rate of growth. It is to define, within each context, the appropriate patterns of production, taking into account the most pressing social needs and the most pertinent resource constraints".* [14]

This is a good starting point to redefining our problem, which requires references to other activities beside production alone. The problem of economic growth is to choose selectively patterns of production, of consumption and of distribution of goods. These choices must take into account the most pressing priorities of scarcity, the relevant resource and energy constraints, and the output limitations, in any given context. Saving and investment patterns must be directed toward reducing the major scarcities, whether of produced or non-produced goods. All this is saying that the quality of growth should come in the first place, rather than the quantity of growth that has dominated our thinking and acting so far.

[12] See *Economic Growth,* Nat. Bureau of Economic Research, New York, 1972.

[13] OECD list of recommended social concerns: *OECD Observer,* June 1973.

[14] Report of an Ecumenical Consultation on Global Environment, Economic Growth and Social Justice – Cardiff, September 1972, in *Anticipation* no. 13, p. 6.

5.3. ECONOMIC GROWTH BELONGS TO A FAMILY OF CONCEPTS.

It is all very well to restate it in such terms. But as we have allowed terms like "choice of patterns", "most pressing priorities" and "constraints" to enter, have we really achieved an improvement? The answer will be "yes" if, in redefining economic growth, we can free it from its identification with material growth. But above that, to deliberately insert these terms is necessary, because they help to place economic growth in a wider framework of concepts, from which it should no longer be separated. The critiques of section 3 and 4, and this definition, place it in a family of concepts which control and regulate economic growth, keeping its attention on those things which are properly its subjects. The highest member of this family is social justice, whose field of action is the basic institutions of society itself. Justice is primary to economic growth, which can go on in a just or an unjust social framework. The justice of the institutions will determine how and whose pressing priorities are chosen. Economic growth may be instrumental in re-inforcing the power of a certain institution, but it can never create it.

The economic system is broader than we thought.

The criticisms of our narrow-mindedness in viewing what constitutes the economic system are, however, rightly aimed at the concept of economic growth itself. It must be broad enough to embrace aspects of other systems which production and consumption effect. Section 4 took up the new physical context in which economic growth must be redefined, showing the broadening scope of the concept of economic growth. Allied to broadening in physical perspective is the added need to extend the time perspective on which economic policy decisions are made. Our practice of rapidly discounting the future will only serve to defer certain problems until later, while limiting the options which future generations may require to solve them. The criticisms of the measures used for economic growth can only partly be met by redefining this concept; the job of construction of new social indicators is only possible when the goals of the society are clarified. Economic growth is a means, and therefore secondary to goals. The goals of the development of societies are generally broader, more fundamental than reduction of a scarcity of certain goods. In the educational task of raising the discussion of people to goals themselves, the churches have an increasingly important role.

5.4. THE GOALS OF SOCIETIES.

A broad debate centred on goals is really only beginning. What is however becoming clear is that qualitative aspects are appearing more frequently, and perhaps already taking precedence over the quantitative. In industrialized societies, for example, the goal of full employment in terms of a job of work for everyone, is being gradually replaced by goals like a satisfying employment, with some security, with human working conditions, and with participation in production decisions – the quality of the work as against a quantity of work available; the quality of the social organization at the production place, against the quantity of goods produced; the purpose and quality of the good itself, rather than the number made or the size of it. Quality is more concerned with the relationship of something to its surroundings, than is material quantity. And of course quality involves values, while material quantity involves them not at all.

The use of the concept "Quality of life" is an attempt to introduce non-material, social and psychical elements into the goals of development. The special task of the church in this should be outstandingly clear. This essay is not the place to pursue this debate on goals and quality further, as this is done in other papers.

5.5. THE IMPORTANT PROBLEM OF MEASUREMENT.

As the debate on the goals underlying economic growth (and other social needs) clarifies itself, further attention has to be given to the problem of devising adequate indicators to measure progress to these goals. Here the economist is involved, along with scientists of other disciplines, particularly other social sciences. A misconception can arise here that measurement only applies to material quantities. Measurement, suitably generalized, applies to any aspect of something which has a value to somebody; and of which he can say, when given two things (or situations or choices) to compare, "this one has more value for me, than the other". The scientific problem of measurement comes in when we seek a form of measurement which everyone will agree to use.

The discovery of standard units to measure length, or of money to measure wealth, though we now take it for granted, involved insights of importance for man. It is not essentially different when social scientists search for indi-

cators of social and psychical things, just corresponding more complex. The discussion on social and non-material measures is a field where ethical and theological insights are required. [15]

Economic theory and distributive justice.

This discussion leads us again into the question: what is meant by social justice?

It should be noted here that economic theory has traditionally taken a rather sterile stand in the issue of distributive justice. The traditional view is that interpersonal comparisons of utility or satisfaction are impossible, as there is no yardstick for personal happiness. Thus, economic theory maintains that one cannot say that an additional dollar of income gives greater satisfaction to a hungry man than to a millionaire.

A more constructive approach is advocated by J. Tinbergen, [16] who wants to take exactly the opposite point of view as the starting point of the analysis of distributive justice. Tinbergen starts from the principle that all men are equal in every sense (and not only "for the law" or "for God"), except when it can be established by observation – which often implies measurability – that they are not equal. As long as we have no concrete knowledge about people being different from each other (in a specific aspect), one should assume them to be equal. In other words, the burden of the proof is shifted to those that maintain that a difference exists, e.g. in the satisfaction derived from a certain level of consumption. Research along these lines may improve our understanding of the implications of distributive justice, at a time when this concept is likely to become of greater importance in all societies.

5.6. FUTURE ECONOMIC GROWTH IN WORLD PERSPECTIVE.

It is impossible to predict what developments may take place in the coming decades; no one knows. What we do know is that scarcities will continue to exist, and that human needs will have to be met by utilizing limited resources that are or can be controlled by man. Therefore, economic growth remains an important policy objective – for any future in which people will be living on this planet.

The extraction of resources, the production of goods, and the effects of the emission of residuals are now all truly global affairs. Resources and fuel are transported across the globe, across any national boundaries; the products are traded globally; the biosphere has no national bounds in its transmission of pollution. Production growth may benefit one part of the globe while its negative effects are suffered in another part. Any redirection of economic growth will therefore have to be done in a global context.

There is no consensus, however, on the specific goals of future economic growth. On the basis of the above discussion the authors of this paper have come to a normative view on the tasks of economic growth – a view that may be held by others as well but which remains a subjective judgement. The main elements of this view are presented in this section.

Our starting point is the conviction that the economic process should be subject to criteria derived from the conditions for social justice. This implies that the organization of the economic process – or the economic system, or the economic order – should be such that social injustice will not be perpetuated or even strengthened, but, on the contrary, with the help of economic growth be lessened. In many cases this means that economic institutions will have to be reformed or renewed, both at the national and at the international level, if economic growth is to be beneficial to increased social justice. In the context of the present paper, this point cannot be worked out more fully; we merely want to underline here that economic growth makes sense only in a framework in which a reasonable degree of social justice can be attained.

Also in a framework conducive to social justice, limitations to economic growth will exist. As we have seen above, a great many uncertainties prevail as to the precise level of the various limits. Nevertheless, the physical and biological dimensions of the earth are not limitless, and our responsibility towards future generations should induce us to act with great care in utilizing the world's resources. This principle applies everywhere in the world, but it is parti-

[15] For a beginning of such a discussion see: "A Theological Critique of Scientific Rationality" – Church and Society, June 1973, p. 8. Quality of Life – Criteria for Measurement.

[16] In *De Economist,* no. 2, CXXI 1972, pp. 106-121 (in Dutch).

cularly relevant for those countries where production and consumption per head have reached high levels. The existing inequality between rich and poor countries in the levels of material well-being, and the need to fairly distribute the burden of socio-economic tensions over the countries of the world, both point in the direction of a gradual slowing down of growth rates in material production in the rich countries, and an increase in the growth rate in the poor countries. [17]

The first goal of economic growth must be to reduce the scarcities of people lacking the minimum for life, wherever they happen to live. This require the working out of minimum levels of living in different contexts, and the incorporation of targets for consumption and distribution (and not only for production) into development plans. This is not entirely new. What is new, is the demand of the logic of the closed system: an assured minimum material level in a limited context implies setting complementary goals of a justifiable maximum to material consumption. In a national or regional economic plan, it is accepted that certain production growth (in certain sectors or certain localities) is stimulated, while growth in production in other sectors or places is correspondingly constrained. So it must be in future global development planning.

We must prepare quite soon for working towards a global development strategy which recognizes this. A logical complement to a requirement of accelerated production growth which aims to alleviate poverty, will be a selective restraint on production (and consumption) in already prosperous regions. It must be remembered that (see section 2), once the basic material scarcities have been effectively eliminated, true economic growth need not be associated anymore with increased production of physical goods. Thus this requirement of restraint may itself be fully consistent with true economic growth in all regions of the world, concurrently.

This distinction is of profound importance. If we were to continue to build global policies equating economic growth with material growth, we would find intolerable contradictions awaiting us. Where there is poverty, this would probably deepen both relatively and absolutely; where material needs have been reasonably satisfied, new scarcities would be induced, both in the quality of things, and in non-producable goods – air, water, land and nature. A just distribution of goods would become virtually unreachable; and the limits of the physical earth, its resources and its biological systems would eventually await us to drive home the final lesson of these contradictory policies. It would be tragic to see the prosperous enter a conflict over the resources which are needed for economic growth in poor regions. In fact, by doing so, they might be creating negative economic growth for themselves, while denying the means for positive economic growth elsewhere.

C. THE PROBLEMS OF A DOUBLING OF WORLD POPULATION

One example of their complex and dynamic nature – food supply.

One of the major problems facing mankind in the remaining decades of this century – and most likely also in the next century – is the rapid growth of world population and the pressure on the world's limited resources created by greatly increased population numbers. Barring calamities of unprecedented magnitude, it would seem to be certain that world population in the near future – around 2010 – will double its present size. At the Free University in Amsterdam a study is being undertaken to determine whether it will be technically possible – even for a world population of twice the present size – to provide every world citizen with the material requirements for a decent human life, and if so, what policies should be followed in the areas of production and distribution in order to meet these requirements.

Working out the idea of minimum level of living targets.

The basic package of material goods required for human life consists of four components: (a) food, (b) housing and sanitation. (c) means for health services, (d) infrastructure for education. In addition, a certain amount of (e) "other

[17] The Europe-North America Conference at Pont-à-Mousson gave attention to this need, though there was no very clear consensus on how it should be done. In all sections it was mentioned.
E.g. *"The industrialized nations must be persuaded at all levels from government to individual to reduce rates of consumption of threatened resources. This must be accompanied by an improvement in the condition of the poor in all countries, possibly achieved through new forms of resource-conserving growth in developed countries coupled with new patterns of income distribution. Such reduction in resource consumption will increase the probability of human survival and allow a more just distribution of world resources among the nations." Anticipation,* no.'15, p. 4.

goods and services" (like e.g. clothing, furniture, kitchenware, transport, recreation) will be required. It is a matter of judgement what levels of provision are adequate and acceptable; norms are being formulated, whenever possible, on the basis of internationally accepted standards.

Methods of the study.

The scope of the study is worldwide; for obvious reasons, regional disaggregation is essential. In fact, part of the work is being done at the country level. Apart from economic magnitudes, demographic and environmental variables are being studied. It is extremely difficult to explicitly incorporate social and political factors and processes; in a rudimentary way this might be achieved by distinguishing different types or classes of social and political systems. One explicit goal included though, is an improved global income distribution, envisaging the gap reducing in a series of steps.

A dynamic model is being built, using methods and techniques as developed in mathematical economics and econometrics. The aim is to build firstly a descriptive, analytical model that will be used to analyze those problems which may arise as a consequence of population doubling if past behaviour and government policies were to remain unchanged. Secondly, the model will be used as a policy or planning model – i.e. the descriptive or analytical model used "backwards" – in order to determine those policy measures which would be required if the basic package of material goods is to be available to everyone. Also the implications of additional targets – such as a high level of employment – may be studied.

Due to our conviction that problems connected with food supply are still pre-eminent and agriculture basic to other economic growth, efforts in our limited time are for the present almost entirely focussing on the agricultural and food problems.

What lies behind the question: Can a doubled world population be fed?

The common denominator of all agricultural production is the process of photosynthesis; this process is at the heart of the technical equation describing output per hectare as a function of inputs of plant nutrient (including water). Another technical relation shows how much labour and/or capital can effectively be used. Still another set of relationships describes the behaviour of the farmers or peasants. Technological progress in agriculture plays a role as well.

Links to rest of economy; adequate supply factors.

Obviously the agricultural sector does not function in isolation of the rest of the economy. There is an important link with several economic activities producing inputs for agriculture. First of all, inputs of fertilizer will usually be needed to reach higher levels of output. Mechanical equipment may be required to work together with labour, or partly to replace it. Transportation is required for bringing part of the output to the consumer, and for bringing fertilizer and other inputs to the farm. The production of fertilizer, the operation of machinery, transportation, sometimes even storage – all these activities cannot be performed without an input of energy. Availability of all these (direct or indirect) inputs into the agricultural sector have to be ensured and the consequences of scarcities or price changes in these ascertained (e.g. energy, capital for fertilizer production).

Water and pollution.

Still other interrelations have to be studied. An input of crucial importance is water – primarily produced by nature. Distribution of rainfall is rather uneven however, and local surplusses may be badly needed elsewhere (or at another time of the year) for irrigation. In large parts of Asian and Africa, agriculture could hardly be developed without irrigation water. On the other hand, not all the water falling or flowing on a piece of land is used up during the growing season. Water leaving the agricultural production process may carry with it part of the chemicals that have been brought onto the land. These agricultural residuals enter other parts of the biosphere; what are the effects? Toxic substances used in modern agriculture may also be transported through the air. Therefore, the pollution aspects of agriculture have to be studied. In a broader context the question arises: what ecological disturbances might be created by extending more and more the area under cultivation, with the consequent loss of variety in vegetation?

Demand limitations.

It will be difficult indeed to gain adequate insight into all these issues related to the question of future output levels of agriculture. And we have not yet closed the circle: it is not only a question of adequate production and supply potential, but the demand side has to be taken into account as well. Without sufficient demand for food, farmers will not produce (except for their own needs). Demand can effectively increase only if the (non-agrarian) population has enough buying power, and this in turn depends on productive employment at reasonable wages.

Agricultural production (in particular food crops) in developing countries cannot gain momentum, while effective demand remains stagnant. But at the same time it should be remembered that an increase in effective demand does not necessarily stimulate the small farmer to produce more; this depends on the agricultural institutions that may or may not be conducive to a positive response by the farmer (type of land ownership, credit facilities, middlemen, etc.).

Trade and investment.

Finally, an analysis of the agricultural sector in the various parts of the world has to take into account that countries and regions are not isolated units but are mutually linked through international trade and investment. With only few exceptions, all countries aim at a rather high degree of self-sufficiency in food production; nevertheless international trade in foodstuff and other agricultural commodities is of great importance. A world-wide study of future agricultural development has to pay attention to the mechanisms of world trade and world market prices that to a certain extent link the various national sectors. Differences between countries in socio-political system (market economies vs. centrally-planned economies) and in development level (rich vs. poor countries) influence the way in which countries are linked to the world market.

Other sources of food.

Agriculture is by far the most important source of food products for human consumption, either directly (vegetable products) or indirectly (animal products). Indirect consumption of plant material, i.e. through the intermediary of domesticized animals, is relatively inefficient in terms of the caloric value lost in the conversion process. A change in the ratio between direct and indirect consumption of vegetable products would change ultimate availability of food in terms of caloric value, and might therefore play a role in a world food policy. In addition to agriculture, the contribution of fishery to human food requirements should be taken into account. It will not be easy to assess the possibilities of non-conventional food production; expert opinion differs rather widely on this point.

The above survey of the agricultural production process in its relation to other activities and processes is certainly not exhaustive. It merely serves to illustrate the complexity of finding an answer to the (simple?) question: will there be enough food for a world population of more than 7 billion people? No straight-forward answer will be possible. The best we can do is to try to find out where the major bottlenecks to a sustained increase in agricultural output are likely to be found. On this basis, policies could hopefully be designed so as to overcome as much as possible the forces limiting future output levels. For millions and millions of people, the food situation is already a very miserable one; to try to meet this basic human need, now and in the future, for all people is perhaps the greatest challenge to economists and policy makers in the coming decades.

ETHICS OF NATURAL RESOURCE USE

by John Francis

1.1. WHAT ARE RESOURCES?

For the most part, the current debate about the impact of industrial technology on the human environment is concerned with the nature, the distribution and the utilization of physical resources. A physical resource can be generally defined as 'something to build with', so that it embraces the group of commodities which any advanced economy has come to regard as essential, viz., fuels, metallic and non-metallic elements, building materials and water. The chain leads forward to the direct conversion and utilization of these commodities in buildings, roads, vehicles, tools and weapons. There are, of course, many examples of physical resources that cannot be conveniently classified in this way. A large area of land can be regarded objectively (for sound ecological reasons) or subjectively (for purely aesthetic purposes) as an environmental resource. The use of this land as a site for mineral extraction or building would, according to the above definition, allow it to be classified as a physical resource and therefore essentially non-renewable; if the land is potentially fertile, then under good agricultural practice it can become the basis of a biological (or renewable) resource.

New principles of resource management are obviously required if the mistakes of the past are to be avoided. The challenge to our ingenuity is whether it may be possible to retain our appreciation of environmental resources in the broadest sense, while still enjoying the benefits of their physical and biological potential through a carefully planned and harmonized interaction with nature.

It is necessary to appreciate the cyclical pattern of our dependence on the availability of natural resources and their continuing consumption. The periodicity of a biological cycle is found to be the same order of magnitude as the life expectancy of the longest-lived participant which, as in the case of the human life cycle, is usually not more than a hundred years. Interaction with other cycles of short-term duration, such as the hydrological cycle with a periodicity of one to ten years, can thus take place within a convenient time-frame, enabling all the various benefits of recycling, replacement and regeneration to be achieved in practice. Under this criterion, biological resources and even certain physical resources such as water and solar energy may be regarded as renewable.

By comparison, the time-spans for most geological cycles are invariably expressed in millions of years. It is obvious that most of our physical and environmental resources are a straightforward legacy of the early history of the earth. There will be no second crop, so that to all intents and purposes, these resources are non-renewable.

This separation into renewable and non-renewable resources can never be regarded as complete. At any point in time, the differences in classification will be a direct function of the available technologies through which certain resources become obsolete and others generate a critical dependency. In the same way, renewable biological resources can be increased by the use of non-renewable fertilizers and arable land, but there are limits beyond which even the principles of good management cannot reach. A non-renewable resource such as oil – which has been described recently as 'too noble to burn' – is only destructible in terms of human destiny. In physical terms, the combustion products become part of the carbon and hydrological cycles, while in statistical language, the event is simply recorded as an increase in the state of disorder. In the increasing darkness of the environmental crisis, it is vital that we do not lose sight of where we are and of the truly human timescale to which we are bound.

1.2. RESOURCE LIMITATIONS

A simple pyramid of resource consumption can illustrate our dependence on the availability of naturally occurring elements in the earth's crust (Fig. 1). Although a massive consumption of carbon is indicated through a world-wide utilization of fossil-fuel energy sources, other elements such as nitrogen, sulphur, potassium and calcium, that are most commonly a constituent of agricultural fertilizers, will also be increasingly in demand. It is perhaps significant that less common metals, e.g. copper, lead and zinc, are frequently the basis for discussion of resource limitations because the availability of these elements is largely governed by the following factors:

(i) a combination of economic and technological conditions relating to financial and energy costs of extraction.

(ii) the levels of production that would take place with a substantial price movement in the world commodity markets (rapidly rising prices may well suppress the planned production levels in future years as in the case of oil).

(iii) the level of production that could take place under future technological conditions (e.g. techniques for the 'in situ' gasification of coal may be advanced to capture the energy content of offshore coal reserves where direct mining is not practicable).

(iv) the nature and quantity of the total stock of resources within the earth's crust, i.e. this factor signals a departure from the more traditional accountancy of metal-rich ore bodies.

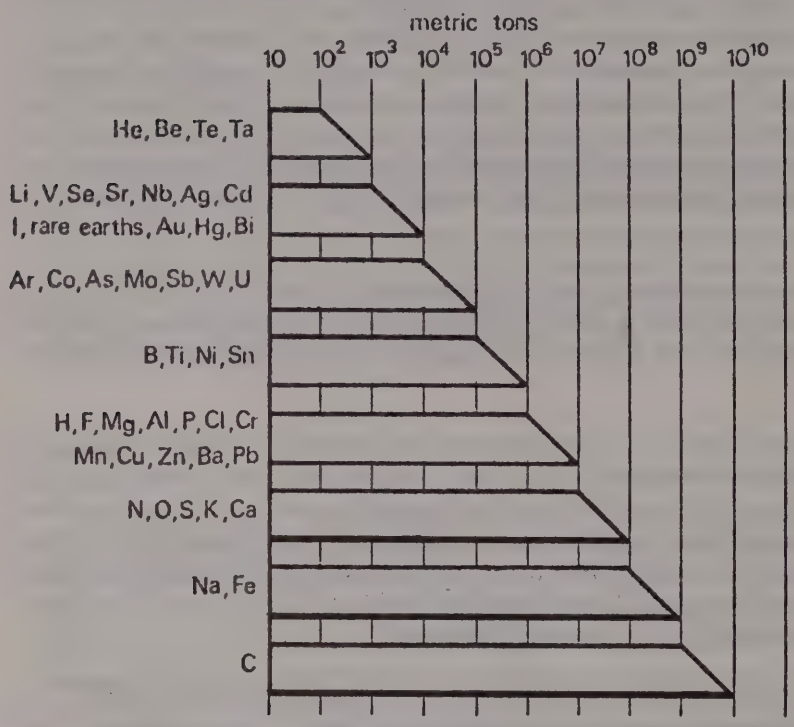

Figure 1 World consumption (1966 data) for the 47 most commonly used elements (*Note:* Rare earths are grouped as one element, although there are really fourteen). [1]

The interdependence of these factors will be necessarily conditioned by the directions and rates of technological change, incorporating new systems for the extraction and processing of ores. It is therefore arguable whether future predictions concerning the availability of certain non-renewable resources can be set down in terms of 'total stock'. Major international corporations involved in the extraction of natural resources, particularly mining or oil companies, tend to classify their reserves as 'that proportion of the total resource stock known with reasonable certainty to be recoverable in the future under existing economic and operating conditions'. With profitability as the driving force behind such concerns, these are described as extractable reserves (sometimes 'published proved' or even measured reserves) in the statistical reviews available through industrial or governmental channels. It should be clear that potential reserves are thus loosely classified in the literature as 'identifiable but not currently extractable'. The boundary between extractable and potential reserves has been considerably blurred in recent months by the sharp upward movement of commodity markets.

The whole question of defining specific resource limitations is therefore clouded by uncertainties that are outside the framework of G.A.T.T. (General Agreement on Tariffs and Trade) or any other international system of price regulation and control. In a paper published by the World Council of Churches in 1971 under the title – 'The Human Environment and Responsible Choice' – it is salutory to recall the following paragraph:

> *Even if it is not persuasive, the evidence is overwhelming that economic growth alone, without redistribution of power and resources, will not bring justice. Recent indications that weaker countries, by pooling their efforts, can demand higher prices for their products, as in the case of oil, are small yet encouraging signs of change in a favourable direction.* [2]

There is very little doubt that the suppliers of other vital raw materials will attempt to emulate the apparent successes of the Organization of Petroleum Exporting Countries (OPEC). Through a monopolistic stance, this group of producing countries has almost literally brought the major international oil companies to their knees; the full effects of the quadruple increase in the posted price of Arabian crude oil during December 1973 have still to be evaluated throughout the less-developed world, leave alone those countries that are better equipped to accommodate to a sudden and alarming balance-of-payments deficit. The web of economic interdependence that has been largely created by the industrialized countries is about to be severely tested. There is a genuine concern that the politics of petroleum will become the politics of copper, of aluminium, of phosphorous, of uranium or of any other strategic material. The implications of this threat to international trade and to the cooperative management of resources has not yet been fully appreciated. These stresses and strains may be all too easily carried forward from energy and mineral wealth to the food and agriculture that underpin the human capacity to survive. While the purchasing power of the American dollar has been declining in industrial markets, it is significant that North American dominance of cereal exports is even greater than Middle Eastern dominance of energy. The United States is not only the leading supplier of wheat and feedgrains to the world market, but it is bidding fair to become the leading exporter of rice as well. Monopoly is the very nature of power in the contemporary world.

1.3. FUTURE OPTIONS FOR RESOURCE UTILIZATION

Moving onwards from problems of definition and the broader issues of stocktaking at an international level, it is essential to grapple with the possible options that may be available at different points in the spectrum of resource consumption, from the high technologies of the industrialized countries to the subsistence agriculture of the many others. The baseline for such an examination can be quoted directly from the report of a W.C.C. Consultation held in Cardiff in September 1972:

> *Any level of* **use** *not just increasing use, if sustained long enough, ultimately exhausts conventional, non-renewable resources. Two essentially different alternatives exist if we desire long-run occupancy of the earth:*
>
> *The first alternative is to organize human activity in such a way that it relies completely on the natural or biological systems based on current energy flow and materials recycling.*
>
> *The second alternative is to push back the physical constraints limiting human activity through continuous application of sophisticated technology. (This) . . . approach, if implemented successfully, and without serious side effects, increases the carrying capacity of the earth, thereby making possible a larger population at a higher material standard of living . . .*
>
> **The technological alternative is only feasible in a society that is rich enough and sufficiently well organized to generate scientific advances.** [3]

The computer models developed in the 'Limits to Growth' study at M.I.T. have been much criticized for their under-estimation of the resource base that may be unlocked through technological innovation. The authors of the report [4] acknowledge the complexity and interdependence of the many factors governing the supply of any mineral resource, e.g., the varying grades of ore, production costs, new mining technology, the elasticity of consumer demand, and substitution of other resources. They illustrate the argument with a scenario for the future availability of a single metal, chromium:

STAGE 1: The annual consumption of chromium grows exponentially, and the stock of the resource is rapidly depleted; the price of chromium remains low and constant because new developments in mining technology allow efficient use of lower and lower grades of ores.

STAGE 2: The demand continues to increase, but the advance of technology is not fast enough to counteract the rising costs of discovery, extraction, processing and distribution; the price begins to rise, slowly at first and then very rapidly.
(This reflects the present state of the market).

STAGE 3: The higher price causes consumers to use chromium more efficiently and to substitute other metals for chromium whenever possible.

STAGE 4: After 125 years, the remaining chromium, about 5 per cent of the original supply, is available only at a prohibitively high cost, and mining of new supplies falls essentially to zero.

From this presentation, the authors derive the quite unremarkable conclusion that 'given present resource consumption rates and the projected increase in these rates, the great majority of the currently important non-renewable resources will be extremely costly 100 years from now'. Under present circumstances, the regulatory market mechanism has ceased to function and has now been largely over-ridden by major political factors, which may effectively suppress demand without any corresponding reduction in price. The availability of a metallic resource, such as chromium, may thus be subject to considerable fluctuations until the market stabilizes under some new condition of price parity that will serve to balance supply against demand. It is logical to assume that since this turn of events has taken place sooner rather than later, i.e. substantially before the known limits of the resource are approached, then the resource base for the particular commodity is thereby considerably extended. If resource costs remain high then the incentive to introduce policies of recycling and better product design will remain within the industrialized countries. Unless split tariff agreements are reached with respect to certain key commodities, then it would seem that a further economic barrier has been erected to prejudice the pattern of world development outside these countries.

While resource constraints exist, whether through the 'use of the oil weapon' in the Middle East and the nationalization of mineral resources elsewhere, there is a general consensus of opinion that we have already entered the transitional period during which critical decisions must be taken and implemented concerning a major redirection of our technology, particularly that relating to resource consumption. Although the length of this transition period will obviously depend on the present state of development within a particular economy, there are many who believe passionately that the main change of direction must now take place within the time frame 1985 to 2000.

There has been a good deal of informed criticism of the assumptions on the stock of non-renewable resources that characterize the 'Limits to Growth' approach. A team of World Bank economists has attempted to stand the study on its head by suggesting that we should draw our confidence from history:

> *The expansion of the last 100 years could not have been sustained without the new resources of petroleum, aluminium and atomic energy. What are tomorrow's possibilities?*[5]

This argument can be put down on the grounds that past history is a classical example of irrationality, waste and neglect as far as patterns of resource consumption are concerned. The counter argument is perhaps more plausible, viz., that many things **become** resources over time. Particular examples are often quoted such as the imminent potential for exploiting resources on the sea bed.

> *Reserves of nodular materials – the most promising underwater source of minerals – distributed over the ocean floor are estimated at levels sufficient to sustain a mining rate of 400 million tons a year for virtually an unlimited period of time. If only 100 million tons of nodules are recovered every year – a target which appears to be within reach in the next 10 to 20 years – it would add to the annual production of copper, nickel, manganese and cobalt to the extent of roughly one fourth, three times, six times and twelve times, respectively, compared to the current free world production levels.*[6]

If it can be agreed that we have not so far adequately solved the problem of production, then it can be agreed with equal veracity that the major flaw of today's pattern of consumption is not really that we consume too many final goods and services, but that we use our resource inputs extremely inefficiently. At the same time, it must be acknowledged that the consumption patterns and the distribution of goods are far from even, and there is very little evidence that we can expect much improvement in that direction. The problems of opening up new avenues of resource exploitation therefore immediately raise questions of equity that can only be resolved by extensive international co-operation.

The timescale for the negotiation and drafting of treaties relating to the resources of the sea bed beyond the Continental shelves and beneath international waters will inevitably be protracted. This is in the very nature of international law, but the practical management of the resources is already being forced upon us under pressure from the recognized resource constraints on land.

Extraction of the metal-rich outcrop on the sea bed, that has already been mentioned as a technological possibility, will serve as a perfect case in point. It has been suggested that an interim arrangement for the management of manganese-nodule production might be entrusted to the International Bank for Reconstruction and Development (the World Bank) and its affiliates. While operations on a commercial scale could conceivably be under way as soon as 1975 or 1976, there is no prospect of an international ocean regime being established and capable of functioning by that time. The conventional wisdom is that through the agency of the World Bank it might be in the interest of the world community at least to cash in on the revenues from this exploitation of the common heritage of mankind. Although this is necessarily a pragmatic stance in the absence of any surveillance system capable of monitoring and controlling activities in international waters, it would also be an excellent opportunity to establish a matter of principle and perhaps also create a valuable precedent for the machinery of international co-operation on future questions of resource management.

It is reasonable to ask whether in the period following the Stockholm Conference (June 1972) there have been any signs of hope that an international resource bank will be established with special drawing rights for countries in the developing world.

2. INTERNATIONAL CO-OPERATION

2.1. THE HUMAN ENVIRONMENT: BEGINNING

A mountain of print is the sobering aftermath of the first U.N. Conference on the Human Environment, but this fact alone should not mask the more intangible achievement that for two weeks in June 1972, the official delegations of 114 countries met together in Stockholm to consider among many things the principles and problems of resource management. There was a formidable level of representation and participation outside the body of the main conference; but with one or two notable exceptions, this has proved to be a far more transitory phenomenon. The fact that this volume of opinion materialized at all is sufficient testimony that such issues are far too important to be left to governments, which in themselves do not properly reflect a long term view.

There is an element of paradox in all that, but whatever the outside view may be, the Stockholm Conference was in every sense the turning point in a new art. The selling point of the Conference – the Declaration on the Human Environment – was conveniently identified in the background papers as:

> *the first attempt to give expression to an international consensus on an environmental ethic and on the basic principles that should guide the environmental relationships of the international community.*

The appeal for stewardship and the wise management of precious limited resources was further translated in the finally published text of the Declaration, but with deferential use of the language of diplomacy. Among the 26 principles that were adopted are three that relate specifically to the consumption and use of natural resources, i.e.

- The natural resources of the earth including the air, water, land, flora and fauna and especially representative samples of natural ecosystems must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.

- The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved.

- The non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that benefits from such employment are shared by all mankind.

2.2. ACTION WITHOUT RESOLUTION

Behind the facade of fine words and phrases, there was in the person of the Secretary-General, Maurice Strong, a determination to create a new framework for environmental control, an Action Plan, bringing together the principal recommendations of the Conference originally passed under the section headings, Human Settlements, Natural Resources, etc. In the official text, the target area remains blurred:

> *the purpose of this action plan is to establish the basis for concerted international attack on major specific environmental concerns and long term objectives.*

It has been more simply described as 'a blueprint for international co-operation'; the broad definition of the areas that make up the Action Plan certainly reflect this vital element of interdependence:

(a) the global environmental assessment programme (Earthwatch);
(b) environmental management activities;
(c) international measures to support the national and international actions of assessment and management.

The framework of the action plan has been represented in diagrammatic form to surmount the more obvious problems of definition. [6]

ENVIRONMENTAL ASSESSMENT	ENVIRONMENTAL MANAGEMENT
Evaluation and review Research Monitoring Information exchange	Goal setting and planning International consultation and agreements
SUPPORTING MEASURES	
Education and Training Public Information Technical Co-operation	Organization Financing

At the end of the day, the U.N. Conference on the Human Environment adopted 109 recommendations for action at the international level, which were all safely stacked within the two major boxes and the supporting structure. Among the recommendations (19 to 69) on environmental aspects of natural resource management, there are obviously a great many new links to be forged between the Environmental Programme and the Food and Agriculture Organization of the U.N., since land and water resources clearly dominate this sector with a very high order of priority for all countries.

The recommendations governing the distribution and use of non-renewable resources are unfortunately a grey area singularly lacking a specific proposal or at the very least a positive sanction on the policies of 'rapid and thorough exploration and economic exploitation' that are the driving force behind most industrialized economies. This is all too clearly reflected in the defeatist nature of the text beneath, **Recommendation 56:**

> *It is recommended that the Secretary-General provide the appropriate vehicle for the exchange of information on mining and mineral processing, etc.*

2.3. PITFALLS AND PROSPECTS

The special problems of energy demand and supply were given some brief attention under the terms of Recommendation 59, but with our present experience of the politics of world energy, this evaluation now appears to be exceptionally tame and, in any case, the element of stocktaking that is involved would be hardly practicable for strategic reasons.

> **Recommendation 59**
> *It is recommended that the Secretary-General take steps to ensure that a comprehensive study be promptly undertaken with the aim of submitting a first report, at the latest in 1975, on available energy sources, new technology and consumption trends, in order to assist in providing a basis for the most effective development of the world's energy resources, with due regard to the environmental effects of energy production and use: such a study to be carried out in collaboration with appropriate international bodies such as the International Atomic Energy Agency and the Organization for Economic Co-operation and Development.*

Since the energy debate is currently the principal focus of world tensions, this proposal will be considered in greater detail in the next section. It is doubtful whether the general dependency of most countries on Middle East oil can be satisfactorily resolved in the near future without severe economic penalties being imposed on the poorer countries. To that extent, the concern expressed in an earlier W.C.C. position paper [2] has already been borne out in practice, i.e.,

> *One of the major pressure points is the approaching exhaustion of certain non-renewable resources. In some cases, as perhaps with certain fuels, the problem of depletion may be handled successfully by shifting to new sources of energy to accomplish the same social ends. However, there is a disturbing lack of consensus among the experts as to whether such sources of energy will be available in time to meet this exponential curve of rising demand. While some assume that the transition is possible and can be made relatively smoothly, others expect that the exhaustion of conventional sources will create major crises with serious social consequences.*

Even within tight economic groups in the Western world, there is a very limited spirit of international co-operation regarding the shortfall in fuel supplies, and yet the implications for certain sectors of industry can already be detected. For example, a recent report from the E.E.C. in Brussels indicates that the car industry at present supports, either directly or indirectly, approximately 10% of the population of Europe. Over the last ten years, it has had a growth rate of about 8% p.a., but the events of recent months have already raised a large question mark over the future growth prospects for the industry. With a real sense of urgency, the European Commission has requested expert opinion to be collated on the probable development of the car industry over the next ten years. Is it possible that an uneven distribution of resources within a powerful group of trading nations would cause them to neglect the further weakened bargaining position of their neighbours?

Again the appeal to a dormant spirit of international co-operation and reconciliation can be found buried among the recommendations of the Stockholm Conference:

> **Recommendation 62**
> *It is recommended that the Secretary General, in co-operation with Governments concerned and the appropriate international agencies, provide that studies be conducted to find out the connection between the distribution of natural resources and people's welfare and the reasons for possible discrepancies.*

In response to this cliché statement, there is an understandable tendency to reject the bureaucracy of the U.N. approach and to ask for a proper degree of public accountability among those agencies that are largely responsible for resource exploitation on a world-wide scale. A more radical formulation can be found among the paragraphs of the Dai Dong Counter Declaration at Stockholm in June 1972:

> *The exploitation of material and regional resources by foreign corporations, with a consequent outflow of profits from the exploited regions, has resulted in a vast and growing economic disparity among nations and a monopoly of industrialized countries over production, energy, technology, information and political power.* [7]

While directly challenging the sovereignty of industrial states, there is also included a sensible reservation to the effect that the use of these resources should not be dictated by the accidents of geography, but must be allocated in such ways as to serve the needs of the world's people in this and future generations. The machinery to achieve this more equitable distribution remains obscure, but from the tentative stance of the various U.N. agencies, there is very little challenge to the status quo, so that the long term prospect must be one of sustained inertia. There is from within a failure to acknowledge this essential weakness in the official posture, and vague hopes for better things to come. Grounds for hope are very slight indeed in view of the shifting foundations of commodity prices or the spiralling rates of inflation that are endemic in most market economies. International co-operation will nevertheless become increasingly essential as we begin to grapple with the problems of world development in the future. The ability to generate the massive capital inputs required to promote new technology would seem to be limited to those countries that are largely self-sufficient through their indigenous natural resources – in agriculture, in energy and in minerals. Elsewhere, the freedom to choose must be restored through public examination of the future options whatever the scale of investment. While this element of participation was noticeably lacking in the U.N. statements out of Stockholm, the non-governmental organizations did manage to assert their voice in this most sensitive area of politics:

> *Decisions on natural resource development should be preceded by examination of their environmental and social impacts. Where technical resources are not yet available for such evaluations, they should be developed as speedily as possible. The findings of such examinations should be made public prior to conclusive decision-making.*

This could clearly be an important area in which to begin the task of international co-operation through the co-operative assessment of new technologies, the joint funding of research capability and the subsequent development of the technology, in manpower and materials. Apart from the avoidance of unnecessary duplication of effort within industrialized countries, such a programme would more directly enable both industrialized and developing countries to manage their natural resources in the interests of sustainable levels of production within the recognized constraints of financial and energy cost control.

3. ENERGY SCARCITY

3.1. PRINCIPLES OF ACCOUNTANCY

Under the pressure of resource constraints that have been generated through O.P.E.C. (Organization of Petroleum Exporting Countries), many countries have now turned towards a more systematic evaluation of their long-term energy requirements. It is accepted that the era of cheap energy derived from low cost petroleum, extracted and marketed by international oil companies, is now at an end. New principles will be introduced in industrialized countries to minimize the energy burden imposed through a dependency on crude oil supplies from the Middle East and elsewhere; a new science of energy accountancy will emerge to optimize national fuel policies taking the following steps:

(i) Predict the energy consequences of investment decisions relating to new industry and technology;

(ii) Identify energy-cheap practices that could be used more extensively;

(iii) Identify energy-intensive practices that could be made more efficient, used less or eliminated altogether;

(iv) Provide guidance in the design of integrated minimum-energy technologies and economies, which would allow the marriage of outputs from one process with inputs to another (e.g., the waste heat from thermal power generation of electricity can be used effectively for domestic purposes by decentralization of the electricity supply network in large urban centres).

If conservation of energy remains high on the check list of tomorrow's certainties, then there will be a number of repercussions for other areas of resource consumption, particularly those relating to the extraction of metals. The economic laws governing the availability of an important metal, such as chromium, have already been mentioned in Section 1.3. It is also important to make the connection with the facts of the energy equation, which must also balance if industrial societies with a high consumption pattern are to begin to make the necessary adjustments or substitutions.

While there is currently no shortage of iron ore anywhere in the world, it is clear that rising prices will make it worth while using ore with a lower percentage of iron. Large cost increases are involved in extracting 0.5 per cent metal from ore bodies when formerly industry was using stocks containing 3 per cent metal. While these increases can be attributed to more complex and to more capital intensive technologies, a principal cost factor is usually the much greater use of power required. In energy terms, substitution of one metal for another in a particular application does not produce the final answer, e.g., aluminium requires twenty times more energy to extract from ore than iron does.

In other words. as resource constraints on non-renewable resources come increasingly to be recognized, the escalating cost of energy will sharply limit their availability through the energy-intensive extraction of low grade ores. This will, of course, place an immediate premium on the recycling of most metallic materials, with a corresponding sharp reduction in the waste products of a high throughput economy. Thus far greater emphasis must be placed on:

(a) recovery of waste materials for use in their original form, and
(b) recovery of waste for use as raw materials for other processes.

Despite a positive movement in this direction, the rapidly inflating price of raw energy via petroleum is the single largest factor that will influence the future growth prospects of economies in the industrialized and in the developing world during the coming decade. It is essential that the facts arising out of this new situation should be properly appreciated.

3.2. STOCKTAKING

The starting point for the debate over the future availability of oil must be a technical assessment of the world's recoverable reserves, taking into account the production practices that may increase the level of total recovery, together with any other factors leading to the cumulative appreciation of reserves. It is claimed that such estimates can be made with reasonable accuracy, and consequently, in recent months, a number of export voices have been heard in the attempt to provide a basis for stocktaking. The estimates provided by one major oil company are particularly revealing since it is asserted that:

> *if our assumptions and deductions on availability are correct, increase in demand cannot be met after about 1978 and an actual decline in production of conventional oil will occur in the mid eighties* **unless something quite unforeseen occurs.** *(underlining by the author).*[8]

It can be argued with justification that a quadruple increase in the price of crude oil during the latter part of 1973 represents such an unforeseen chain of circumstances leading to the present crisis of distribution. There is, of course, the immediate possibility that the extraction of oil from "non-conventional" sources, viz., tar sands or oil produced by treatment of solid minerals such as coal and oil shales, will now be economically competitive with the established patterns of production in oil-producing regions. The present remaining recoverable reserves of liquid petroleum consist of 570 billion barrels and it is believed that outside the Middle East there is only a handful of other prolific basins which far exceed the yield of average sedimentary areas.

> *These include the Lake Maracambo area, certain small basins in California, the Gulf Coast districts of the U.S., the North slope of Alaska, perhaps Libya and, last but not least, the Northern North Sea. Important though most of these are in terms of local value, none of them compare with the Middle East and of these, only one contributes more than 5% of the world's total, i.e. Texas and Louisiana which contribute 8% of total discoveries.*[8]

The U.S.S.R. is the only country outside this frame of reference where the undiscovered reserves are probably greater than those in the Middle East. It is argued that even if the whole of this Soviet potential were available to the world market, it would postpone a decline in total world production by about only ten years.

There is a consensus among the most recent estimates of an ultimate world total between 1,600 and 2,000 billion barrels of recoverable reserves, i.e. roughly double the amount that has been already found. Present world oil production is 57 million barrels per day (or 21 billion barrels per year). Since 1948, the average rate of finding oil outside the communist countries has been 18 billion barrels per year, and it is forecast that finding rates will not exceed 20 billion barrels per year during the next decade before the inevitable decline in the reserves to production ratio is expected to occur.

These figures suggest that the world consumption of oil is surprisingly close to a "steady state" condition between "annual consumption" and "new production", but this criterion would only apply if the demand was regulated at close to the 1973 level. The question is whether, in view of the escalation in world oil prices, this could conceivably be the turning point on the rising curve of global consumption. A forced deceleration at this stage could clearly have serious, even tragic, implications for the established pattern of world trade and development, but it could at the same time encourage a revaluation of energy consumption in industrialized countries that would, at the least, reduce their dependency on the world oil market. If the oil companies maintain that the increase in demand could not in any case have been met after about 1978, the present crisis conditions may well turn out to have been providential. At least there is still the possibility that an equitable solution to the longer term supply problems may be achieved without further serious international conflict.

The hard line view of rising prices on the international oil scene has been interpreted by a leading commentator as follows:

> *Demand – even in the medium term – will be automatically adjusted to the scarcity situation through the pricing mechanism. This will price oil out of those markets which cannot afford to pay higher prices for it, so altering the shape of the demand curves and making societies more conscious of energy conservation – as, for example, in their insistence that mass transit facilities replace the use of private cars for commuting whilst long distance rail passenger and freight transport replace the use of air and road facilities. Societies will, in other words, have to become less "energy hungry" and oil will lose part of the dominance that it has secured in energizing development.*[9]

This reflection on the current market situation may well be true for those economies that have the freedom to adjust their investment pattern and to control the level of individual consumption. It clearly cannot be applied with any validity to a subsistence economy where yet another life-line to food and agricultural production is thereby threatened. This predicament has already been debated at the Washington Oil Conference called by the U.S. Secretary of State, Dr. Henry Kissinger, in February 1974, when it was acknowledged that even the best co-operative efforts between nations will offset only a fraction of the serious damage which has been done to many countries by the abrupt and spectacular increase in oil costs. Action to resolve the plight of the developing countries where bigger oil import bills threaten to wipe out most of the development aid must clearly be given an immediate high priority. Apart from sustaining the flow of aid from industrialized nations, these countries will require a huge infusion of new aid from oil-producing countries to offset the disastrous impact of soaring fuel and fertilizer costs on already emaciated economies. The problem is whether these additional economic penalties will once again obscure the continuing struggle for distributive social justice. The scale of unfulfilled human needs will never have been made more obvious.

3.3. SMOOTHING THE DISTRIBUTION

Among the oil-producing countries, there is clearly a divergence of views as to how this problem should be handled. Some countries have large populations and a general need therefore to finance development through the sale of oil, while others controlling more limited reserves may consider it more appropriate to limit the production rate in order to extend the lifetime of the oilfields. There is still the special case of those countries with smaller populations and very large reserves who may find that the oil revenues far exceed the absorptive capacity of their economies. The relative positions of some of the producing countries vis-à-vis the current assessment of reserves and the capacities of their individual economies to absorb oil revenues is shown in Fig. 3. The question of how to deal with surplus revenues generated by oil production at the new posted prices is a matter of serious international concern as the potential disturbance of the monetary system would have profound effects on all countries. The scale of the problem can best be illustrated by examining the position of Saudi Arabia set against all eighteen Arab countries – (see opposite) .

It is already clear from these figures that many countries in the industrialized world that have come to depend on cheap energy supplies via crude oil from the Arab states will now be facing an alarming balance of payments deficit. Any attempt at rapid deflation of these economies in the short term in order to resolve this embarrassing situation could have a damaging effect on world trade which would, in turn, create havoc among the weaker economies of the developing world. In order to avoid such a "domino effect", there must be an international agreement between the oil-producing and the oil-consuming nations on the manner in which surplus revenues, such as those generated by Saudi Arabia, can be invested without precipitating such a disaster.

TABLE 1. OIL REVENUES "
($1 bn = $1,000 million)

	1971 $	1974 $
Saudi Arabia		
Oil revenues	2 bn	20 bn*
GNP	4 bn	25 bn
GNP per head	520	3,100
All 18 Arab Countries		
Oil revenues	6 bn	60 bn**
Combined GNP	41 bn	105 bn
GNP per head	330	780

** Saudi Arabia oil revenues assume output of 8m b/d (i.e. 1973 rate pre-cutbacks), and an average take of $7 a barrel.

** Oil revenues for all Arab countries assume combined output of 20m b/d (1971: 15m b/d), and an average take of $11 for Libya and $7 for the rest.

Proposals have been submitted to the World Bank and the International Monetary Fund to create two funds that would be financed largely from surplus oil revenues. These include a special development fund that is designed to help the developing countries which have no oil of their own and whose development programmes are threatened with a catastrophic setback because of higher oil prices. In addition, an emergency fund may be set up to help finance oil imports to industrialized countries so that they will resist the adoption of deflationary policies and the temptation to cut aid programmes. Inevitably, the impact of higher prices, not only of oil but of other raw materials, will add to the already inflated cost of manufactured goods. There is consequently a very real danger that the spiralling effects of inflation, excited by the recent scarcity of cheap energy, will once again cause attention to be diverted from the struggle to achieve a more equitable distribution of resources on a world scale.

In the present climate of uncertainty as to whether oil prices will stabilize at the 1974 level, it is argued that there is no way that the higher costs of oil can be met except at the cost of reduced personal consumption of other things. On the other hand, economists maintain that energy (defined in the broadest sense) has long been in a condition of high elasticity of supply for the following reasons:

(i) energy can be produced in many different ways;

(ii) technology seems on the brink of bringing in more powerful new ways (solar energy and nuclear fusion would be two obvious examples);

(iii) the distribution of energy can be greatly improved (decentralization of energy production can result in large gains in overall efficiency);

(iv) economies of energy use can be easily achieved. (It is suggested that this latter condition could result in a glut of energy arising out of the present scarcity).

Whether these views are proved to be correct or not, the present fears arising out of the 1973 conflict in the Middle East are real enough. In the light of the "limits to growth" debate, it would appear that the whole of the industrialized world is now reacting in such a way that the necessary course corrections will be made. The interjection of an "artificial" resource constraint has thus resulted in a significant over-reaction on behalf of the body politic, although there is currently no suggestion that this will be accompanied by a corresponding value change as far as the pursuit of material goals is concerned.

The use of the "oil weapon" has nevertheless caused the Western world to rest a while on a plateau of resource consumption. There is no disputing the fact that many political leaders are restless to pursue the mirage of endless

economic growth, but this enforced pause may be sufficient to persuade a great many others of the futility of this approach. If that is found to be the case, then a proper ethic of resource consumption will have been reinstated in the heart of the community. It may then be possible to insist that man has "come of age".

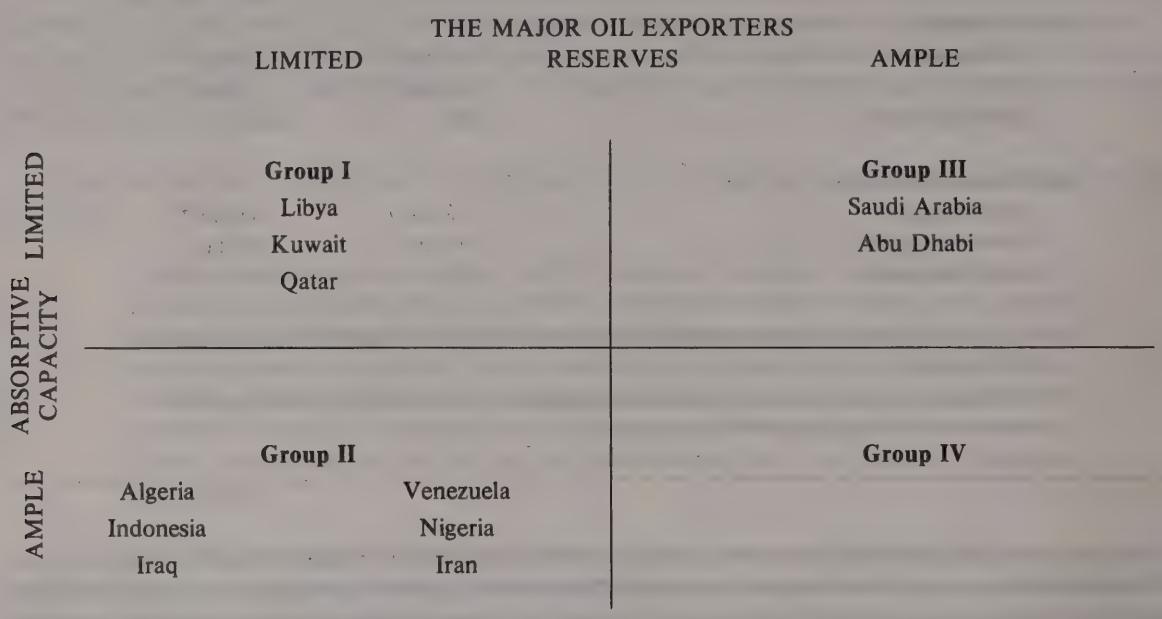

Fig. 3 This diagram shows the potential capacity for the generation of money (reserves on present assumptions) and the apparent capacity to absorb such financial resources (absorptive capacity). It poses a problem which may require solution; it does not imply it is insoluble. [10]

NOTES

1 *Resources and Systems,* The Open University Press (U.K.), 1973, S26 – Block 1, p.7.
2 *Study Encounter,* Vol. VII, No. 3, 1971, p. 12.
3 *Anticipation,* No. 13, December 1972, p. 9.
4 Dennis L. Meadows et al., *The Limits to Growth,* Universe Books, New York 1972, p. 63.
5 *Nature,* Vol. 239, September 1972, p. 248.
6 Peter Stone, *Did We Save the Earth at Stockholm,* Earth Island, 1973, p. 151.
7 Dai Dong Independent Conference on the Environment, Saltsjö Boo, Sweden, June 6, 1972.
8 H.R. Warman, *The Future Availability of Oil,* F.T. Conference on World Energy Supplies, London, 18-20 September 1973.
9 Peter R. Odell, *The Geographical Journal,* Vol. 139, Part 3, October 1973, p. 447.
10 G. Chandler, *Energy: The Changed and Changing Scene,* Institute of Petroleum (U.K.), June 7, 1973.
11 The Economist, January 5, 1974, p. 68.

QUALITY OF LIFE AND TECHNOLOGICAL OPTIONS: THE AFRICAN PERSPECTIVE

by Benjamin C.E. Nwosu

As we reflect on the discussions, the study groups and the conferences held by the Department of Church and Society of the World Council of Churches (WCC) in the last four years on "The Future of Man and Society in a World of Science-Based Technology", a question arises. What are the technological options open to man now and in the future? This paper attempts to summarize the views of many participants from the so-called Third World in general, and from the African continent in particular. The author tries to put forward an answer to the question: What technological options are available which would guarantee a good quality of life not only for Africans, or the Third World for that matter, but also for the whole human race? The solution proposed is short and concise, but by no means an easy one. For, as will be seen, the framing of the solution appears superficially contradictory in the first place. Secondly, it would appear to be in opposition to recent events, e.g. the temporary successes of the oil producing countries over the stronger industrialized countries in the recent energy crisis. Perhaps we may recapitulate the definitions worked out over the last four years of the criteria for measurement of the quality of life. At the Leuenburg (Basle) meeting, we finally agreed on the following criteria:

1. A concern for the "Quality of Life" which is a truer measure of development is proposed either as an alternative to parameters now in use like GNP, which is a quantitative measurement of the total goods and services produced in a country, or as a corrective to them. However, the developing countries do not as yet see fit to abandon the criterion of GNP until they have achieved a minimum subsistence level.

2. The alternative parameter – Net Economic Welfare (NEW) – seems more desirable in that it includes demands of distributive justice. The reservations put forward at the Leuenburg conference are that quantification of NEW is not easy. The view of the author is that the essence is not quantification of criteria, but rather a new emphasis on material as well as non-material qualities. All the same there is available evidence that the Net Economic Welfare can be characterized by at least stating those aspects that are negative, e.g. absence of high rates of suicide, crime, drug addiction, mental illness, etc. In other words, it is possible to establish within reasonable limits what we can call a good quality of life which is not entirely material but also spiritual.

Based on the above understanding, it is the thesis of this paper that the poorer nations of the world have to work towards *cooperation rather than confrontation and self-reliance rather than dependence.* This conclusion is reached not necessarily from any deep religious feeling but from an assessment of the reality of the situation as we now see it and can reasonably predict it for the future.

Geneva, June 1970

The first world conference on the issue of the future of man and society was called in June 1970 in Geneva. This meeting was quite exciting for the following reasons:

1. It was the first time that an ecumenical meeting of scientists, technologists, industrialists, social thinkers and theologians was called on a world level.

2. Compared with subsequent meetings on this topic, there was a larger percentage of scientists involved in the discussion and, by and large, these were very competent in their fields. They brought into real focus the technological advancements of the age and possible consequences for the future.

3. For the first time one realized the identity of interests as well as expectations of the technologically developing nations, despite the very large differences of geography, cultural background and economic status.

However, despite this excitement it was very clear, even at this early period in the study, that issues to be discussed would largely be determined by participants from the highly developed countries. Therefore the immediate concerns of the Geneva conference were problems arising from *over-affluence* – pollution, population growth, computers, genetic engineering, etc. It took a very determined effort on the part of participants from Africa and the rest of the Third World before problems arising from absence of technology or inadequate technology were raised and discussed. These are problems of malnutrition, hunger, disease, poor communications and shelter, which are just as disastrous, if not more so, than pollution or the environment crisis. We therefore succeeded in injecting the whole problem of transfer of technology for discussion and clarification. It is pertinent to quote again one of the conclusions of the conference on the transfer of technology: "Knowledge and the means to use it involve power. The knowledge technology affords is concentrated both in the hands of little groups of experts and in the hands of the richer developed countries . . . The developing countries know that they have no power to control their own future without the technology and power which is in the hands of the rich countries or of the powerful international corporations". [1] It is interesting to note that at a recent meeting [2] Dr. Banjo of the ECA has this to say: "When two communities come into conflict, either through competition for survival or for the material resources available to sustain economic needs, the community with a better technology of warfare usually comes out successful from the conflict". Thus a significant achievement of the Geneva conference was to highlight the point that technology is essential not only for raising the living standards of the poorer nations, but also for guaranteeing them the power they require to control their own destinies.

Unfortunately there has not been any follow-up on this most important issue raised at that Geneva meeting. The only concern that was taken up later was the environment issue. The UN-sponsored Stockholm Conference on Environment was actively supported by representatives of the Third World, in particular Africa. The success of that conference is a measure of the *cooperation* from the poorer nations who really are not the villains of the environment or the pollution crisis. On the other hand, problems arose from the big powers wrangling about who was to participate in the conference, and under what conditions. Anyway, the main point which should be raised here is that the African countries cooperated to find a solution to a concern which, as stated earlier, is largely that of the highly developed countries, whilst the issue of transfer of technology has not been taken up on a global scale.

Nemi, June 1971

From the exciting meeting of Geneva we moved to the Nemi meeting in 1971. The Nemi meeting initially appeared to be a failure from the African perspective. Again it forgot the concerns of the rest of the world and concentrated on burning issues in the Western World. We were introduced to "Images of the Future" and the "Limits to Growth" debate.

The Images of the Future debate was highlighted by a lecture on the "Counter-Culture". Again in a spirit of cooperation, we from the developing nations listened attentively to understand what the issues were all about. Then it became clear that technology had set in motion forces which tended to dehumanize man. The counter-culture was therefore an attempt to get out of the "cage" in which technology has imprisoned man. A participation in one of the pre-arranged "happenings" (a contradiction in terms) further showed that the joys which European and American youth were seeking in counter-culture could be obtained for practically nothing in any typical African village. So while technology was imprisoning and/or dehumanizing highly technologically developed countries, e.g. Europe, America and Japan, the absence of technology gave the African freedom to enjoy himself. However, lack of technology did not give the African the freedom to have regular harvests, to control drought, to fight infant mortality or endemic diseases, etc.

From the foregoing it would appear logical to conclude that what the highly developed countries needed was less technology and the underdeveloped countries more technology. And hopefully the human race would establish a lower and upper boundary for technology *not* at the present levels.

One can then imagine our consternation at the introduction of the Limits to Growth debate. According to this theory, resources – non-renewable resources – were limited. The earth itself was finite. So no amount of technology can stretch these limited resources indefinitely. In fact, on the present level of consumption and pollution we dry up or blow up by about 2030! Probably technology could extend things a little bit, say another 100 years, i.e. 2130! How-

[1] David Gill, *From Here to Where? – Technology, Faith and the Future of Man,* Report on an Exploratory Conference, WCC, 1970.

[2] A. Banjo, *The Role of Technology Policy Planning in Development,* Paper presented at IDRC/ECA meeting Ile-Ife, Nigeria, Dec. 1973.

ever the authors of the limits to growth theory give some hope. If everyone stopped where they are now and somehow made some more effort at population control, "recycling", and cleaning up the environment, then all would be well.

Now all of us, including the Africans, are agreed that there are non-renewable resources, that present consumption trends cannot be kept up and that something has to be done to change present life styles in the affluent countries.

But the problem is : who should make the sacrifice? Should the Africans (the majority of Africans – not some Lagos VIP's who fly to London at the weekends to watch the première of a film or to play golf with their notable friends) make this sacrifice? A talented, youthful M.I.T. scientist, the chief exponent of the limits to growth at Nemi, did suggest that we all mark time. The advantage of this, he stated, would be that the gap between the rich and the poor countries will remain constant instead of widening as at present.

The United Nations declared the sixties as the development decade. During this period the developed countries were to make available one per cent of their GNP to be used by the poorer countries. The performance record on that decision is well known. [3] It was a total failure both in quantity and quality. It required the Arab-Israeli war – confrontation – to extract what must be at least one per cent of the GNP from the developed countries in the form of higher prices for oil. "Does progress necessarily depend on confrontation?" [4] If increased oil prices will mean a better life for the poor and a reduction in the extravagances of the rich, then it is progress. But will it? The chances are that it will not. So confrontation brings only temporary gains.

Accra, March 1972

One of the best things to come out of the Nemi meeting was a search for more perspectives. Due to constraints of time, money, and location of conferences such as Geneva and Nemi, only a very limited number of representatives from the less technologically developed countries were able to attend. Hence the idea of regional meetings was agreed upon. In addition one sensed a genuine and quite natural sensitivity of our white brothers towards constant criticism from us. This was more so because the record of such as attended these meetings was decidedly on the side of the poor and oppressed, both within their own countries and without.

So at Accra the ball was in our court. The meeting was exciting and fruitful. The report [5] speaks for itself:

> *"The cardinal aim of every government should be the raising of the overall living standards of all its people. In a highly competitive world such as ours, science and technology constitute a major tool for a speedy realization of that goal.*
>
> *The meeting in fact went further to outline details and strategy, the implementation of which was to speed up the realization of a technologically oriented Africa, self-reliant, independent, and with a vast majority of its people enjoying a comparatively satisfactory standard of living."*

The report noted that: there has been only a little, if any, measure of success in the realization of the above goals. It attributed the failure to the following factors:

1. poor planning, with built-in conflicts;
2. lack of sustained political will;
3. insufficient basic research into and knowledge of local natural resources;
4. growing élitism and alienation of the élites from the masses;
5. inadequate documentation and dissemination of available research data;
6. insufficient regional cooperation on fundamental research leading to duplication in research efforts and also to unnecessary dissipation of meagre financial resources;

[3] See chapter on International Development Policies in *Development in a Divided World,* edited by Dudley Seers and Leonard Joy. Penguin Books Ltd., 1971.

[4] B.C.E. Nwosu, *Scientific Technology and the Future of Africa,* The Ecumenical Review, vol. xxiv – no. 3 – July 1972.

[5] Report of the West African Church Conference on "Science, Technology and the Future of Man and Society", Accra, March 24-30, 1972.

7. foreign vested interests.

The report continues:

"In order to be fully effective and relevant to the solution of problems in the African context, the application of science and technology must involve the community in its entirety; for those in authority, for instance, there is need for total conscientization (that is, sensitizing their conscience to their moral and social obligation to the whole community); for those to be affected by the technological innovations, important attitudinal changes are required; and for the scientific research staff there is the rather special problem of evolving a technology appropriate to the problem in hand. In this context, a technology is considered appropriate only when it meets the following criteria:

1. it should be relevant to the special needs of the vast majority of the people;
2. it should encourage the use of indigenous ingenuity and skills;
3. it should as far as possible use local resources;
4. it should be geared to the level of the capacities of the people in each of these areas: (a) technical skills, (b) fundamental attitudes, (c) manpower and capital resources."

Post Accra

The report of the West African conference was well received. However, a regional meeting of the industrialized nations held in Pont-à-Mousson, France, was worried about the implications of self-reliance. The Leuenburg meeting provided opportunity for clarification. It was pointed out that self-reliance does not mean isolation or the rejection of all aid. The ideology of self-reliance points to the need for relationships which do not threaten domination of the developing nations or perpetuate their dependence. Self-reliance has as many psychological implications as economic or political ones. The African scientist must feel that he is able to formalize and improve upon his traditional science. We do not need to go to the moon but we cannot continue endlessly to be mere consumers of products (good or bad) of other people's creativity and ingenuity.

In Nigeria very little use has been made of local scientists and technologists in creating new industries. For example, despite the fact that during the civil strife a group of scientists had constructed an oil refinery practically from scrap, under wartime conditions, with a capacity of about 80,000 gallons of petrol a day, the next Nigerian oil refinery is to be constructed entirely by French "experts". The existing refinery was constructed by the British.

And yet scientists and technologists have not given up, despite frustrations from within and without. Quite recently the University of Ife in Nigeria hosted a conference sponsored by the International Development Research Centre (IDRC) and Economic Commission for Africa (ECA) on "The Creation of Centres for Technology Policy Studies in Africa". At this meeting,[6] as it was in Accra, the point was again made that "technology is the motor or tool of development". However the conference warned that "change in society due to technology can be positive or negative. Technological development is a necessity so it must be properly guided".

The IDRC/ECA meeting also considered the issue of self-reliance. Was it not advisable to take a political decision for technical self-reliance, by cutting the external contracts for the purchase of technology? It was argued that such a policy of isolation would tend to create the climate of hardship which could stimulate the development of local sources of technology. The consensus at the meeting was to opt for moderation and realism, what this paper terms cooperation. The meeting affirmed that, "The regulation of the external flow could, in some sectors, follow a policy of self-reliance; in other it could follow a policy of relying mostly on foreign technology, but always trying to incorporate gradually an increasing share of locally generated technology".

Cardiff, June 1972 – Leuenburg (Basle), June 1973.

The subsequent meetings in Cardiff and Leuenburg have more or less been clearing houses for ideas generated in the previous conferences.

[6] IDRC/ECA Conference quoted.

In Cardiff, Schumacher made his eloquent speech on "Small is beautiful". It was an exposé of the philosophy of the Intermediate Technology Group. He elaborated his theme to include new technological options not only for the Third World but also for the industrialized countries. From the African perspective, we do not wish to be tied to the concept of small is beautiful. Because we are small technologically speaking, our technology will of necessity be small for some time to come. But surely the level of technology required in Nigeria in the foreseeable future, taking in all the constraints of optimizing resource use, eliminating pollution and regulating population growth, etc., must be higher than that of Belgium or Portugal. Hence the concept of appropriate technology as defined by the Accra conference is the answer.

In our search for technological options, we must be guided by our concept of the quality of life. The Leuenburg summary is ideal though not necessarily set in proper order of priorities. It reads:

"We can envisage the following goals for all societies:

a. Satisfaction of the basic needs for food, clothing, shelter.
b. Suitable health and social services available to all.
c. As many options as possible open to all in education and culture.
d. Opportunities for creativity, innovation and the realization of potentialities.
e. The fullest attainable participation of all members of the society in decision-making and the fullest sharing in the rewards of social effort.
f. The preservation of distinctive cultural and linguistic values.
g. Human settlements designed to provide for community and continuity of human relationships.
h. A balance between population, resources and cultural goals.
i. A dynamic combination of self-reliance and interdependence with other countries.
j. The resolution of tensions and conflicts between nations through methods of peace.
k. Due regard to the needs of future generations, the unborn and the "neighbours of the future", which does not, however, sacrifice the basic needs of living individuals.
l. A sense of spiritual meaning for life.

CONCLUSION

It is tempting to think that man is interested only in himself. Even if this were true, the interests of two persons are not necessarily mutually exclusive. The fact of life is that there is a great degree of overlapping. Take the topical problem of the *energy crisis*. If the oil-producing countries quadruple their prices, this hits not only their so-called enemies – industrialized countries – but also their brothers, many of the developing countries who have no oil of their own. The very people who are quadrupling their oil prices are going back and asking for arms, refineries and steel factories from their so-called enemies. If the industrialized countries continue to exploit the producer countries, as they have been doing for centuries, they wake up to find that they can no longer run their motor cars on Sundays. On the face of it, this is a slight inconvenience. However, it is only a forerunner of things to come. So no one gains.

Surely the answer to the problem is cooperation, not confrontation.

In the developing countries, because of mistrust and jostling for power between ethnic groups and classes within their societies, the talents within these countries cannot be effectively mobilized and utilized for the common good. Consequently the ideal of *self-reliance* continues to elude them. Temporary gains achieved during periods of *confrontation,* such as the creativity which emerged during civil strife in Nigeria, are swept away. *Only cooperation* within these countries can ensure permanent gains, leading to self-reliance and human dignity.

In conclusion I agree fully with Professor Dudley Seers when he says: [7] "Poor countries today have to find ways of developing, not in isolation, but in the actual world of the end of the twentieth century. This is a world of very big inequalities, where the great majority of the capital and professional resources are in the hands of a small minority of countries, which also hold dominant positions in international trade, enjoy the preponderance of military power, and exercise strong cultural influence. These imbalances create special problems (as well as special opportunities) for poor countries and special responsibilities for the rich". A lasting solution of these intricate problems lies in *cooperation rather than confrontation, self-reliance rather than dependence.*

[7] *Development in a Divided World,* edited by Dudley Seers and Leonard Joy.

VALUES, LIFE STYLES AND THE FUTURE OF THE TECHNOLOGICAL SOCIETY

by C.H. Waddington

Throughout the whole developed and developing world, there is a widespread feeling that the systems of value by which man has guided his actions in the last few generations, require re-examination and almost certainly should be altered in many important respects. Hardly any of our older ethical assumptions are unquestioned. The basis for this is partly a moral revulsion against some of the old value systems, which are thought to be unworthy in various ways; but the need to change the ethical bases on which society is organised and people act is forced on us also by the practical demands of world problems. We shall find a solution to the problem of population only under the guidance of a new attitude to the sanctity of life; and the issues of urbanisation, transport, increased leisure, safeguarding of the environment, and so on, which at first sight may appear to be simple material questions, turn out on deeper inspection to involve motivations and aspirations and the value systems on which these are based.

The Primary "Goods"

In considering values, we have to begin with those things which were "good for" or "advantageous" to the animals which were our evolutionary ancestors: adequate food, good health, and the ability to grow up and leave offspring. Evolution is, of course, brought about by the fact that some individuals of a species leave more offspring than others, and therefore contribute more to future generations, a process known as natural selection. This process is not as simple as appears at first sight. For an animal to be efficient in the fact of natural selection, it must not only adapt to a particular mode of life in the ecological system in which it lives, but it must adapt in a way which is sufficiently flexible to allow for modifications when the ecosystem changes, as it inevitably will.

These "goods" are relevant to sub-human animals. At that level of evolution, they can scarcely be considered ethical values, in the sense in which man uses this term. One of the great problems for debate is whence arises the human sense of morality, which marks the difference between an animal good and an ethical value. Throughout most of the world and most of human history, it has been thought that moral values are a development, as it were, of qualities inherent in all aspects of nature, but which man, with his conscious mind and capacity for forming clear thoughts and concepts, has been able to realise and experience more explicitly than other creatures. But churchmen of the Middle Ages in Europe did not think it ridiculous to try animals for crimes such as witchcraft; American Indians apologised to the buffalo before killing it, or to a tree before cutting it down; some extremists among the Indian sects covered their mouths with a cloth lest they inadvertently cause the death of a fly by swallowing it. For people with such beliefs the human soul was only a fuller development of something in which all nature had a share.

There has been a tendency in Western thought which is in sharp contrast with this. At the very beginning of the developments which led to modern science, there was a powerful movement of opinion which held that *Mind* is of an entirely different character from *Matter.* The prime exponent of this view was the French philosopher Descartes. What is known as "Cartesian Dualism" asserts the separation of *Mind* from *Matter,* that the two are quite different orders of existence. But the status of moral values (or "the soul") is left much less clear – partly perhaps because questioning the orthodox doctrines of the Catholic church was a dangerous pastime in those days. It was not long, however, before philosophers of science (the key name in this connection is Hume) urged that values also are quite different from matter, and that matter can be considered without reference to any questions of value, and in fact must be so considered for the purposes of science. This was the dominant view during the early development of science, in the 17th, 18th, and at least the first half of the 19th century. During this period most of science dealt with the inanimate things in the world; the only well developed sciences were chemistry and, above all, physics. The latter, with its precise laws about the behaviour of clearly defined entities, was taken to be the paradigm example of what a science should be. It was confidently hoped by many – not so much the working scientists themselves as those who had read something about the subject – that eventually everything could be explained by physics.

One of the important discussions about ethical values at the present time takes the form of an attack on science, based on two assumptions: that the whole of science is in fact founded on the views just expressed; and, that those

views are the major cause for what is claimed to be modern Western man's devaluation of nature and dehumanisation of his fellows. In my opinion, this anti-science counter-culture is right in many of the positive things it has to say: many of the values it praises are genuine and important ones. But many of its arguments against science are only partially correct and even become dangerous by concealing the main point. Certainly nature should not be devalued, nor man dehumanised. But the Cartesian-Humean-Newtonian view does not necessarily do this. Furthermore recent science, which stresses the importance of biology and the development of physics into much less simple mechanistic theories, is not influenced nearly so much by the Newtonian view as its critics suppose it always must be. Finally, and most important, the real villain in bringing about the sorry state of the world is nothing so abstract as the metaphysical basis of science, but is rather a combination of down-to-earth value systems involving selfishness, individual power, material possessions, and immediate comfort.

But let us see first what some of the critics of modern science actually have to say. There is no space to refer to more than a minute fraction of their voluminous writings. Theodore Roszak's are a good example; although he does eventually find that science is largely responsible for what he dislikes in today's world, he is at least aware of many points on the other side. In his recent book, *Where the Wasteland Ends,* he takes Newton rather than Hume or Descartes as the personification of science; and Blake, who demanded an end to "single vision and Newton's sleep" as the opposing hero. Roszak sees science as essentially the attempt to live up to Bacon's description of it: "We can give credit to Bacon and Descartes that there exists the tantalising assumption, basic to all scientific work, that a depersonalised method of knowing *can* be perfected – and that *only* such a method of knowing gains access to the reality of nature . . . We are agreeing that it is no loss to the scientist personally, or to the culture generally, to strip human thought of its most intimately personal qualities – its ethical vision, its metaphysical resonance, its existential meaning . . . With Bacon and Descartes, we are legitimising an act of depersonalisation, a censorship of those very qualities of mind and spirit which have always been regarded as indispensable to the health of culture." (p. 146).

For Newton himself the world was by no means totally depersonalised. He wrote of himself, "I do not know what I may appear to the world, but to myself I seem to have been only a boy playing on the sea shore, and diverting myself, and now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay undiscovered before me." Insofar as he followed the Cartesian principle of separating the world into a human mind and non-human "matter", he found matter quite as mysterious as mind, being indeed pregnant with God. Newton wrote of the force of gravity, for which he had provided the quantitative rules of operation: "God, being present everywhere by His will, moves all the bodies in His infinite, uniform *sensorium,* and so shapes and reshapes according to His pleasure all parts of the universe, much more than our soul by its will is able to move the limbs of our body." (reference *The Ancient Theology,* p. 255).

But is this darker motif really a part of science? At another point (p. 158) Roszak himself writes "There can be no question but that the worst vices to which the objective style of experience leads – callousness, authoritarian manipulation, simple indifference to the sensibilities of people and nature – are ancient and universal traits . . . Mankind hardly required Bacon's *novum organum* to teach it such criminalities."

And we can ask if science is necessarily based on the Cartesian-Newtonian single vision? Essentially this asserts that our understanding of nature starts from knowledge of the existence of certain physical entities, such as atoms, the force of gravity, and the like. We have to build up a comprehension of more complex things by finding suitable ways of combining these simple basic entities. There has, however, always been in science a very different line of thought. This asserts that our knowledge of nature starts by observations which, when they are systematically prepared and arranged, are known as experiments. This type of thinking accepts that the basis of science includes a human being, the scientist; that the Cartesian splitting of things into two totally different categories, the human mind over against non-human nature, is fundamentally impossible. Total objectivity is a myth, and science cannot be and is not based on it.

Science, viewed as experiments and observations rather than as belief in the totally objective reality of material particles like atoms, electrons and so on, allows us to believe that human values are just as real as anything else we can know about, since they are involved in the observation from which all our knowledge starts.

It is clear that the difference between a human value and a biological good is connected with the fact that man is a social animal, who is able to formulate abstract mental concepts, and to communicate them to his fellows, mainly by means of language. Thus, while animals are concerned mainly with goods for themselves individually – their strength, health, food, sexual satisfaction, and so on – man becomes concerned in addition with goods affecting his relations to his fellows – values such as truthfulness, loyalty, friendship, love. In my book *The Ethical Animal,* I have expressed my own views that the evolutionary transition from biological goods to human values arises from the way

these are related to the processes going on in a child's mind at the time it learns to speak, although I would not deny that other explanations are possible.

Values and the "Ecology Movement"

The recent, sudden, great increase in the concern for the condition of natural eco-systems in the developed nations, and the realisation that their pollution and despoiling are rapidly approaching unacceptable levels, have led many people to ask which of our generally accepted value systems has produced this sorry state of affairs. Since much of the most obvious pollution comes from the industrial application of science-based technology, many immediately jumped to the conclusion that the root of the trouble was an overvaluation of science. The scientists, of course, replied that the cause was not science itself, but its misuse by industry.

However, Theodore Roszak writes *(Where the Wasteland Ends,* p. 212) "It might seem unfair to lay the blame for impending environmental disaster at the doorstep of the scientists. Granted, the rape of the environment has not been carried out by scientists, but by profiteering industrialists and myopic developers, with the eager support of a burgeoning population greedy to consume more than nature can provide, and to waste more than nature can clear away. But to absolve the scientific community from complicity in the matter is quite simply to ignore that science has been the only natural philosophy the western world has known since the age of Newton. It is to ignore the key question: Who provided us with the image of nature, that invited the rape, and with the sensibility that has licensed it? It is not, after all, the normal thing for people to ruin their environment. It is extraordinary and requires extraordinary incitement."

A more balanced view is expressed by John Black, a professional ecologist, in his book, *The Dominion of Man: The Search for Ecological Responsibility* (University Press, Edinburgh, 1970). "The recognition that the use of science to control natural processes has brought the western world to a point when it is beginning to doubt its future survival . . . suggests that ecological breakdown need not have occurred, had the scientific abilities of western civilisation been used in different directions, or used more wisely . . . The reason (for this ecological crisis) is to be found not in science or technology alone, but in the whole complex of ideas on which western civilisation is based . . . Perhaps ecological breakdown will recur until either the environment deteriorates faster than the increases in technology needed to restore it, or man reconsiders his basic attitudes to life, and adjusts his view of his place in the world accordingly." (pp. 17,18).

The main thesis of Black's book is that science is only the latest phase in the development of Judaeo-Christian civilisation and that we have to look to these root values for the basic causes of the evils to which the ecological movement has drawn attention. He tends to go back to the account of the Creation given in the book of Genesis, where in Chapter I God said to man "Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth." This can be taken as a license, if not an order, for what Roszak describes as a ferocious and wanton attack. But as Black points out, the Book of Genesis contains two separate and very different accounts of the Creation. In the second version, given mainly in Chapter 2, "nowhere in (this) narrative of the creation is man given dominion over the animals; the only instruction he receives is that, with one important exception, he might eat freely from every tree in the Garden."

So it is as least doubtful whether even early Christianity encouraged man to attack his natural environment as an enemy to be subdued and exploited. Certainly the record of Christian civilisations in keeping the world a fit place for human living, at least up to the time of the Renaissance, was quite as good as that of any others. The great ecological catastrophes of early civilisation – and there were several – did not occur in Christian lands. The first civilisation of Mesopotamia ruined its environment and destroyed itself by pushing its agricultural productivity beyond what the circumstances would bear, leading to erosion of the fertile soil into the rivers, and silting up of the harbours. The ecology of most of the eastern Mediterranean, particularly the Northern shores of Africa, was also ruined by unduly exploitative agriculture, under civilisations dominated by Greek, Roman and Islamic religions. In contrast it was mediaeval Christianity which turned the somewhat inhospitable, swampy, tangled woodlands of northern Europe into agriculturally rich country.

However, it can be argued that all this changed about the time of the Renaissance. Before then Christianity had been indifferent, if not actually opposed, to science and technology. It judged proposed new developments in the light of their moral acceptability, not their technological promise, and on the whole preferred to keep things as they were.

During these centuries, the science which had developed under the Greeks, and the technological skills of near-Eastern civilisations, such as Egypt, survived because they were taken over by the invading Arabs, who carried them along the north coast of Africa, and eventually into Spain, from where at the time of the Renaissance they spread back into Europe.

Faith, Science and Capitalism

This revival of ancient learning, accompanied by the Protestant revolt against the Catholic Church, soon led to the appearance of extreme Puritan sects, with their ethics of hard work and strict adherence to a number of literally interpreted religious doctrines. The same period in Western Europe saw the consolidation of capitalism. There has been an enormous amount of historical argument about the relations between these three great movements – the rise of science as the main mode of learning, the rise of Protestantism, with its Puritan ethics, to a position in which it eventually had more influence on western man's religious life than Catholicism, and the rise of capitalism as his main system of economic organisation. For a long time the accepted view was that capitalism could only have gained such importance in a Protestant society. Respected authors like Max Weber and R.H. Tawney, argued that one was in effect the cause of the other. Nowadays historians seem much more doubtful if the relation was as close as that. Many of the most extreme Protestants, such as the Scots Highland Calvinists, or some of the English Protestants at the time of Cromwell, such as the Diggers, were anything but capitalists, while many of the Italian capitalist bankers remained good Catholics. In any case, the rape of the environment did not start until the rise of fairly massive industrial enterprises, some two centuries or so after Protestantism and capitalism had come on the scene. In the meantime, it was Protestant farmers in Britan who created the English landscape we now so much admire, and mainly Protestant immigrants into the United States who began to tame the wilderness to make it something slightly more like the Garden of Eden.

When industry did arise, from say the middle of the 18th century onwards, it employed technologies which can be regarded as based on science, although in point of fact the connections between the basic technological inventions and anything which can be called science was much less close than many people seem to think. Nearly all the inventors were practical men coming out of workshops rather than laboratories. It was not until about the middle of the 19th century that professional science, of the kind which we call by that name today, began to be translated rather directly into the industrial technological processes which can plausibly be accused of raping the earth.

The uses to which technology is put are determined much more by other things than by its origin, whether craftsmen's know-how or sophisticated scientific theories. I would argue that, for most the last two centuries, man in the countries which we now regard as developed has been employing every technology he could put his hands on primarily to satisfy his own greed for material goods. Just where this sense of greed has come from is more difficult to say. Partly, surely from the breakdown of faith in Christianity – including its Protestant version which usually involved some sense of stewardship for nature as well as of cooperation with others; partly perhaps from the rise of capitalism, but it should be noted that much the same has gone on in the only developed culture claiming to be non-capitalist, i.e. the Soviet Union. Another strong influence, in my opinion, was the extraordinary situation in which Europeans found themselves when they discovered the Americas, which were so rich in natural wealth and so poor in inhabitants. The early Spanish and Portuguese invaders of Central and South America set themselves almost immediately on a course of ruthless exploitation (undeterred by their Catholic faith). The early settlers of North America, primarily British, were at first more restrained (quite largely by their strongly held Puritan faith), but then adopted the view that the continent was simply there to be exploited. It was, I think, primarily in North America that, in Roszak's words, "the modern west has played the conquering hero in its dealings with nature, attacking it with a sort of ferocity and wantonness that one only vents on a foe little trusted and less to be pitied". Conceivably one could say this also of Australia, though the attack there was certainly less successful, perhaps because the environment was not such a push-over. I doubt if one could claim that man behaved this way in New Zealand or even in South Africa, and insofar as Roszak's words apply to Western Europe, I think it is because of malpractices which have been brought back from America. It is, I would argue, the worship of Mammon, the Almighty Dollar, not Science which has to bear the blame. It is Greed, Get Rich Quick, Turn a Quick Buck, Mine That Soil, Get Your Hands on That Gold, Squeeze Those Bastards Out, Control the Market, that provides the demonic drive to turn God's Own Country into God's Own Junk Yard. And the pseudo-psycho-analytical double-talk about all this, (an excusable overreaction against the bland and dessicated view of the universe man inhabits, for which Newtonian science – or even poor Charles Darwin – is blamed) is more than I can swallow.

This is a pretty pessimistic view. Personally, I think that there are many aspects of western civilisation which have been left fallow for a long time, and which if developed would provide the basis for the kind of world view which Black calls for.

The Responsibility of Science

There are, of course, several criticisms which may fairly be levelled against the science of today. One is that it has allowed itself to be carried away by the extraordinary successes of atomic theories in dealing with the physical world, and has tried to apply these much too rigidly to fields such as human and social behaviour, into which they can provide very little insight. Arnold Toynbee discusses this extensively in his great work "A Study of History", and provides innumerable examples of it in the history of all civilisations, and in all manner of contexts. He speaks of three steps in the process under their Greek names, *Choros,* "the break-through"; *Hubris,* "pride": *Ate,* "the fall". "What is palpably true of military action is also true of other human activities in less hazardous fields where the train of gunpowder which leads from Choros through Hubris to Ate is not so explosive. Whatever the human faculty or the sphere of its exercise may be, the presumption that, because a faculty has proved equal to the accomplishment of a limited task within its proper field, it may therefore be counted on to produce some inordinate effect in a different set of circumstances, is never anything but an intellectual and moral aberration, and never leads to anything but certain disaster." There may well be some plausibility in arguing that Newtonian science was, in say the 1920s/1930s at the brink where Hubris crumbles under one's feet and one finds oneself falling down the precipice into Ate, but with the development of quantum mechanics of indeterminacy, of complementarity, as basic aspects of physics, and of organicism, or Whiteheadianism as a basis for biology, science has certainly done a great deal to rescue itself in time.

The other criticism, justifiable in its way, is that every new advance in scientific understanding raises more problems than it solves. But there again Toynbee in his overview of the whole of human history puts this point into perspective, perhaps best in a quotation he gives (abridged version, Vol. 1, p.180) from Walt Whitman, "It is provided in the essence of things, that from any fruition of success, no matter what, shall come forth something to make a greater struggle necessary". This is surely the only reason why man hasn't been bored to death generations ago; because every insight he acquires in trying to solve one problem makes him realise there is some other question which poses an interesting challenge. If he just concluded that it wouldn't yield a fast buck, and that the problems it raises are a bit too much like work, then he would get bored to death – or become alienated or suffer from identity crises. But so far there have always been enough people who do not take it this way to carry on their shoulders the weaker brethren.

Ecology as a Standard

Many of the young generation of today seem to first come into contact with multi-level thinking in the context of ecology which demands that attention be given simultaneously to many interacting components within a system. The value of this type of thought quite rightly impresses them, but it sometimes tempts them to ask more of ecology than that science can deliver. To quote Roszak again (p. 368) "Like all the healing arts, ecology is through and through judgemental in character. It cannot be value-neuter. . . . What violates the natural harmony must be condemned; what enhances it be endorsed. . . . Ecology is the closest our science has yet come to an integrative wisdom. It, and not physics, deserves to become the *basic* science of the future."

I do not think that ecology, as the biologist studies it, provides anything like an adequate standard for judgement. If a natural eco-system is left to itself, it relatively soon – in periods of say decades – assumes a more or less stable state, in which it continues until disturbed, either by evolutionary changes to some of its inhabitants or by forest fires, floods or other natural disturbances. But these natural ecologies are by no means "good" for man. Consider those that still exist on the planet's surface, the Sahara, the Amazon Basin, much of Siberia or the Canadian Arctic. They are extremely unpleasant places, and static at that, with little tendency to change, let alone improve.

An aspect of science which gives a better notion of dynamic improvement is the study of embryonic development. Since this is my own field, I may be accused of prejudice, but surely it is difficult to deny that a full-grown rabbit running about a field is in some meaningful sense "better" – more of a rabbit – than the fertilised egg out of which it grew, not *ethically* better, but better in some real, if non-ethical sense. Ethical value, as I suggested above, arises only in connection with man.

The valid aspect of Roszak's insight is that ecology does provide an example, relatively easily comprehended, of a system in which many things are inter-related, and which must be considered a system as a whole, rather than as the bits and pieces that eat and get eaten in its operation. The same is, of course, true of a developing embryo; all its organs have to be kept in the right proportions and places relative to one another. But this is perhaps not so easily understood without deeper study. The relevance of ecology to human value is not so much that it provides any basis for judgement, but that it shows the kind of thing about which the judgement has to be made, namely a system of interacting activity – different aspects of human personality interacting with one another, and with natural and artificial surroundings – rather than single isolated traits.

The whole richness of the interacting system in which man is involved is not fully expressed in his embryonic development, which we tend to think of as more or less completed by the time he is born. It involves, in addition, all his activities as a youth and adult. Further, we really have to consider more than just one lifetime, but rather the whole evolutionary succession. Human values inhere in what one might call "human evolutionary ecology". Unfortunately the science we have developed so far can hardly sketch even the crudest outline of this, which I consider the most *basic* science of the future.

Even at the relatively simple biological level, we know singularly little about the ecological relations of the healthy human being with his surroundings. We have concentrated most of our attention on studying and trying to mitigate the pathological conditions and illnesses which afflict him. We scarcely even know how to define healthy nutrition. It is only in the last few years that the first tentative attempts have been made to outline the nature of the more complex and more important aspects of human ecology – for instance in some social anthropology, in the Club of Rome's Predicament of Mankind Project, and in the Ekistics studies on urbanisation. There is a stupendous amount of work still to be done to fill in the details. But if anything which could be called science is to provide any worthwhile help in formulating human values, it will have to be to scientific developments of this kind which include man within their scope, rather than ecology of the normal kind which excludes him. I am afraid that when Thoreau said that "in the wilderness is the salvation of mankind" (the motto of the Sierra Club in America) he was talking nonsense. Anything like a decent human life can stand about five percent of wilderness, but not much more.

Values for a Post-Industrial Society

Many of the people who are urging the importance of a new set of values, and are doing their best to define one do not make an opposition to science, the centre of their thinking, though it often remains part of it. Nor do they all look to ecology to provide them with a pattern. Indeed they follow so many different paths that it is enormously difficult to sketch an outline which does not leave out something of great importance. Perhaps one might say that most of the modern moralists who have begun to make themselves heard in the last two or three decades, start from one or the other – and often both – of two broad fields. One is a moral objection to the so-called developed societies of the present day, mainly on the grounds that they are dominated by greed. The other is the conviction that social relations will have to change drastically for technological reasons: either we shall find that we are running out of natural resources, and that we have to start being more thrifty in our use of them, or that greater use of the computer and similar techniques will remove so many of the routine tasks from men's shoulders that they will be faced with the difficult problem of how to use their leisure in an enjoyable way.

Philip Slater may be quoted as an example of a writer starting from the first field: "What is significant in the new culture is not a celebration of economic affluence, but a rejection of its foundation. It is not merely blindly reactive, but embodies the sociological consciousness that possessions actually generate scarcity. To accumulate possessions is to deliver pieces of oneself to dead things. Every time we buy something we deepen our emotional deprivation, and hence our need to buy something. *This is good for business."* And from that rejection of the values he sees as underlying the present economic functioning of societies Slater goes on to conclude: "There are an almost infinite number of polarities, by means of which one can differentiate between the old culture and the new. The old culture tends to give preference to property rights over personal rights, technological requirements over human needs, competition over co-operation, violence over sexuality, concentration over distribution, the producer over the consumer, means over ends, secrecy over open-ness, social forms over personal expression, striving over gratification, Oedipal love over communal love. The new counter-culture tends to *reverse* all of these priorities." Slater is sufficiently level-headed to see that something more is required than mere acquiescence in these estimable principles. "New culture adherents often display symptoms of *under*-sensitivity to stimulii. Other, perhaps not quite so convincing, spokesmen for this important point of view are following similar lines, for instance, Reich in *The Greening of America,* or Roszak in *The Making of a*

Counter-Culture. There are also some rather different approaches from the moral side, for instance, John Cage, well known as a composer of far-out experimental music, is an eloquent exponent of the most extreme anarchism and repudiation of goal-seeking behaviour of any kind. In composing his music, he goes to elaborate lengths to ensure that every note and every interval is chosen by the most random processes he can discover, so it has as little causal or rational relation to anything else in the piece as is technically possible. The heart beats of the performers probably have *some* effect, tending to regularise their performance, but it must be pretty slight. If it were not, Cage would insist on performance by machines not subject to physiological rhythms. This behaviour, which most people, young or old, are likely to think pretty queer when they first come across it, actually has a rationale. Its purpose is to isolate sounds so that they can and must be appreciated for themselves alone, and not as items in any larger unit. Whether this is an effective method of musical composition is certainly debatable.

However, Cage is probably as good a spokesman as one can find for the anarchist position. This resists presentation in a sequential logical form, but can perhaps be illustrated by the following quotations: "The highest purpose is to have no purpose at all. This puts one in accord with nature in her manner of operation." . . . "Where there is a history of organisation, art, introduce disorder; where there is a history of disorganisation (World Society), introduce order." . . . "There is nothing we really need to do that isn't dangerous".

Some of these ideas are not so far from the types of values advocated by people who approach the subject from the quite different starting point, especially those who ask what we shall have to do with our lives when we have no longer to work so hard merely to stay alive. As a spokesman for this group, I will arbitrarily pick Gene Youngblood, who uses the avant-garde abstract and technically far out cinema as a peg on which to hang some general remarks. "When man is freed from the needs of marginal survival, he will remember what he was thinking before he had to prove his right to live". Then I may interpolate a quotation from Alvin Toffler, "In that super-industrial civilisation of tomorrow, with its fast silent cybernetic intricacies, and its liberating quantities of time for the individual, art will not be a fringe benefit for the few, but an indispensable part of life for the man." And going back to Gene Youngblood, "Life becomes art when there is no difference between what we are and what we do." . . . "The transition from a culture that considers leisure 'a problem' to a culture that demands leisure as a prerequisite of civilised behaviour, is a metamorphosis of the first magnitude, and it has begun" . . . "Perhaps in the near future the whole process of living will be in this active seeking out of experiences".

Although there are both convergences and divergences between the thinkers who are suggesting novel values as substitutes for the old ones, there is here, I think, one important line of thought: that, in the near future, the systems of values of civilised societies which their citizens can follow with full social approval will be, and should be, more diversified; in other words that we are seeing the emergence of an enormous variety of acceptable and socially accepted life-styles.

This view often leads not so much to the strong emphasis on each individual doing his own thing, but rather to smallish groups of people following together for a time a certain life-style, or working on a certain endeavour. As they see it, an individual would during his lifetime change quite often from one group to another – "sub-culture hopping", as Toffler calls it. With each change he would feel himself not so much John Cage's individual, who "keeps his head alert but empty" . . . and "takes it easy, but takes it", – but rather as always a member of a group, even of different groups at different times.

Warren Bennis argues that: "The social structure of organisation of the future will have some unique characteristics. The key word will be *temporary*. There will be adaptive, rapidly changing *temporary* systems. These will be task forces organised around problems to be solved by groups of relative strangers with diverse professional skills . . . This trend is already visible in the aerospace and construction industries, as well as many professional and consulting firms." As he sees it, man as we know him today needs to be "revitalised". And "The elements of revitalisation are:

- An ability to learn from experience and to codify, store and retrieve the relevant knowledge.
- An ability to learn how to learn, that is, to develop methods for improving the learning process.
- An ability to acquire and use feed-back mechanisms on performance, in short, to be self-analytical.
- An ability to direct one's own destiny."

He admits "that the future I describe is not necessarily a happy one". But he does go on to claim that "fantasy, imagination, and creativity will be legitimate in ways that today seem strange. Social structures will no longer be instruments of psychic repression but will increasingly promote play and freedom on behalf of curiosity and thought."

Philip Slater carries further the discussion of what the social consequences of such temporarily organised societies are likely to be, and what value system they are likely to generate. He points out that the individual will probably become more separated from permanent groups that can provide him with ready-made values, and that his knowledge and work will become more narrowly specialised. This will, he thinks, lead at first to "feelings – acute and pervasive – of alienation, of anomie, of meaninglessness. These feelings will, as usual, be misconstrued as an effect of everyone's having become alike, though the striving towards uniformity is actually a secondary phenomenon, an attempt to *counteract* feelings of alienation and anomie." Slater argues that "when an individual loses a more or less permanent role in a permanent group, his specialisation becomes pointless and somewhat burdensome. He becomes a part in search of a whole . . . The only conceivable solution to this problem is, to put it bluntly, the obliteration of differences: the maximisation of uniformity, of homogeneity, of sameness among people . . . (but) . . . Homogenisation could only be tolerated if people were all transformed into full human beings, rather than remaining specialised semi-persons as we are now constituted . . . Each must have the capacity to be introverted *and* extroverted, controlled *and* spontaneous, independent *and* dependent, gregarious *and* seclusive, loving *and* hostile, strong *and* weak and so on . . . Less variety from person to person requires more variety within each person."

So this very different argument, starting from quite a different basis and following another line of thought, has led again to a stress on the importance of increasing the richness of experience and modes of response of the individual to it, expanding out of the narrow confines in which our social organisation tends to confine us at present. Alvin Toffler suggests that this increased richness may come from frequent switching between life styles, each as he describes them appearing rather meaningless in itself. For instance, someone may spend a few years as an adherent of a surfboard cult on the coasts of California, then spend a year or two in an advertising agency before trying a spell as a back-to-nature organic farming drop-out, as a member of a pop group, and so on. Bennis and Slater seem to think much more in terms of each person being rather expert in several specialities, probably in a very narrow field, but not allowing this expertise to take up very much of his time, and spending the rest in a rich, diversified set of activities and personal interactions.

Physical Restraints and Future Life Styles

I think that both these projections have probably omitted an important factor, which I doubt if the future will be able to avoid: the need to be less profligate of energy and natural resources. Only if the physicists succeed in harnessing fusion power can the world even contemplate using energy as freely and wastefully as we have in the past, and even then the need to raise the standard of living of the developing parts of the world may set limits on the amount of energy in which we can allow ourselves to luxuriate. Again, it is almost impossible to see any new source for some of the rarer mineral resources which we are still treating as inexhaustible. I think it is possible that we shall go into a society in which the processes of manufacture will be required to produce objects and machines with much longer lifetimes (possible involving somewhat more servicing) with the expenditure of a great deal less energy. This is likely to be true even in the present so-called developed countries, and I do not see how the developing countries can possibly organise better standards of living for all their populations unless they think along these lines.

For Warren Bennis the four main features of the immediate future are:

- Interdependance, rather than competition.
- Turbulence and uncertainty, rather than readiness and certainty.
- Large scale, rather than small scale enterprises.
- Complex and multi-national, rather than simple national enterprises.

I think no one would deny the second of these, at least in the short term, but the considerations I have just been putting forward seem to me to cast considerable doubt on the last two, and some doubt even on the first. It may well be true that we shall have much more leisure, that we shall make more short-term temporary organisations of work, and we may justify even Slater's rather Utopian argument, by which he transmogrifies "the maximisation of uniformity of sameness among people" into an equity, because all are equally richly and fully developed human beings. But the need to make things – of some types at least – which last a long time, and whose production does not absorb too much electricity or coal or oil, will probably call for the development of a kind of skilled craftmanship, which in the last few decades has tended to have been pushed out of the world by mass production techniques. This type of skill which gives a person the occasion to take a longer view than one that leads only to the next weekly wage packet, has in the past always been one of the main factors around which individuals have built up their sense of esteem and satisfaction. It may well become so again, though presumably in somewhat new ways which one can as yet hardly formulate in detail.

It certainly seems to me one of the values which the developing countries should try hard not to lose from their traditional value systems. They will be going through very unsettling periods of transition. There are already strong attempts to transfer to them major manufacturing plants operating by what have been the dominating systems of mass production. The injection of the capital involved will at first sight seem very attractive and may indeed bring at least some temporary advantages. But the transfers will have been made mainly because the citizens of the developed countries are finding the assembly line and other mass production methods very unattractive ways of spending their time, so that even at present a large amount of this work is actually carried out by immigrants from poorer countries. If we are really going towards a future which places a greater value on quality and less on quantity, and which husbands rather than squanders its resources, developing countries should think hard about the losses as well as about the gains involved in allowing the establishment of mass industries on their territories.

Another major influence on future value systems which has not been mentioned so far, is the general desire, indeed the need, to bring about greater cohesion of mankind as a whole. This arises, of course, from the dangers of atomic warfare on a world scale. It also inspires many of the younger generation, and seems likely to do so increasingly, although it is, of course, opposed by particular nations which desire to further their own ends, by using either their accumulated industrial and technological skills or their natural resources. The validity of various value systems will have to be considered in the light of this movement towards One World.

The values can perhaps be classified in three categories:

(1) Universal values which should be accepted by all members (individuals, nations, or other groups) who form the planetary society. Probably the most important of these is the desire to identify with the whole human race. This does not exclude giving some importance to more local loyalties, such as to a nation, or even a group within a nation, but there is unlikely to be much progress towards developing an effective global social organisation unless adherence to mankind as a whole is given the primary position. It seems to me that such a value system almost necessarily implies granting greater importance to the quality of life – quality in material well-being, health, education, richness of experience and so on – than to the sheer quantity of any particular items, such as material wealth, numbers of persons and so on.

(2) Conflicting values, a belief in which would disrupt the planetary society (e.g. some forms of exclusive nationalism, unrestrained aggressive competitiveness).

(3) "Free" values, which do not conflict with the development of a global society, but are not necessary foundations of it. Different groups could choose to express their individuality by developing one or other of these free values without doing any harm to the planetary society as a whole.

All value systems, which stress the importance of trying to incorporate everybody into some coherent community with their fellows have a tendency to overlook the fact that different people have different tastes and want different things. Recent history has seen several societies which set out, from a historical state of confusion and incoherence, with the aim of integrating themselves into something with an organic unity, only to end up a few years later in some form of totalitarianism. Hitler's Germany, Mussolini's Italy, Stalin's Russia, were all examples. The countries which have accepted the values of individualism and democracy have tended to go about solving this problem by the system of "one man, one vote". It is becoming clear that this does not always work very well either. On the one hand, the citizen may be offered only a very restricted range of choices on which to vote, and these may be selected for him by far from ideal political machines, such as party organisations. Again, if the democratic constitution gives absolute power to the majority, then some minorities may never be able to make their influence felt, e.g. the Blacks, the Chicanos in the United States, the Catholics in Northern Ireland, and so on. Some new type of social apparatus, giving effect to the value of individuality, needs to be developed. Possibly we have been looking at things upside down, supposing that it is the duty of society to define the principles of unity and to make provision for individuals within it, whereas we should perhaps give priority to the individual in all his differences from his fellows, and hope that only a moderate amount of encouragement will be required to allow the social unity to emerge as a result of the interactions between individuals. This is, I think, one of the principles that Mao is following in the present phase of China, although that country seems to have oscillated between imposition of unity from on top, and giving priority to decentralised freedom of individuals and small groups.

Among the "free" values one would wish to see, is very considerable diversity over the world. What were at one time preached as the virtues of the American "melting pot", in which immigrants of all cultures and nationalities were to be moulded anew into a standard American citizen – although it was of course hoped he would be a very high quality

citizen – do not seem likely to appeal to the world as a whole. It is doubtful indeed if they have actually worked out even in the United States itself. If, as one hopes, all regions of the world, as different as North and South America, Europe, the Islamic world, the rest of Africa, the Soviet Union, China, India, South East Asia and so on, are going to work through to a post-industrial society, and achieve the feeling that the quality of their life is at least adequate, it is almost inconceivable that the different paths they will have to follow will lead to a uniform end result. It is much more likely that there will be a wide range of types of society, each containing within itself several, and perhaps many, life styles. We are, of course, already seeing many attempts to formulate value systems and styles of living appropriate to different groups in the world, and to recognise and accept their differences as valuable in themselves. Is "the great danger that threatens Africa, the absence of ideology", as Frantz Fanon once remarked? And if so, what sort of ideology should it develop? "Negritude" or "African Socialism", or what? Must Muslims develop into either capitalists or communists? President Kadaffi certainly does not think so. Is Mao's Cultural Revolution for export?

Among these "local" loyalties there is one of a rather special kind – loyalty to sex. There is no doubt that practically the whole world, developed and developing, has for some centuries at least lived in male dominated societies. Possibly this was not always so definitely the case in some earlier agricultural pre-urban society. Certainly many women, particularly perhaps in developed countries, but not only there, see no reason why this should continue to be so. The feminist movement involves one of the most active restructuring of value systems going on at the present time. This should, I think, be regarded as one of the "free" values, in the sense that global society could exist even with considerable differences in the value given by different parts of it to similarity of treatment and opportunity for men and women.

SCIENCE, TECHNOLOGY AND SOCIETY IN LATIN AMERICA

by Amilcar O. Herrera

INTRODUCTION

In the modern world analysis of the relationship between science and society – and this includes the relationship between science and ideology – must give fundamental attention to technology. Although "traditional" technologies based on practical experience are still being used in many branches of production, "scientific" technology has come to dominate practically every field of human activity. Therefore, when we speak today of the impact of science on society, we are almost always referring to the impact of the technology which that science has created. There is universal agreement that the best way to learn about the material universe and about man as a biological being is through the use of science as an intellectual tool.

This intellectual or functional subordination of technology to science has produced the inverse phenomenon: the control of science by technology. Here the mechanisms work more indirectly; they are less visible, but very effective. They are based on the fact that modern science, as distinguished from that which predominated until the end of the 19th century, requires enormous human and material resources for the full development of its potentialities. The pursuit of science has ceased to be an essentially individual enterprise and has become one which requires undergirding by the whole of society. As a result, its orientation is increasingly determined by the benefits which that society – or, as we shall see later, its dominant sectors – hope to reap from it. The control is exercised through the priorities which are set for the granting of funds, the way in which scientific planning is carried out, the political and ideological conditioning of scientists, the action of great corporations in pursuit of their commercial and competitive interests, etc. As a result of this combination of forces, the major part of present-day scientific activity – even that sector which is described in general terms as basic – is directly or indirectly shaped by the demand for productive equipment (machines, apparatus). Only a very small part – probably less than five per cent – is truly "free" in the sense of seeking knowledge for its own sake.

However, the relation between science – including technology – and society is very complex, even though the mechanisms which we can see at work operate in an understandable way. This is especially true in developing regions where the institutional structure and organization of science have been transplanted directly from the advanced countries, without any regard for their particular traditions and forms of social and political organization. As a result their scientific superstructure – its organization, values, objectives, etc. – is very similar to that of the developed countries. However, its relation to society as a whole is very different.

SCIENCE, TECHNOLOGY AND SOCIETY THROUGHOUT HISTORY

Technology can be defined as the sum total of the instruments or tools, and the knowledge and skills, used to meet all the needs of the community and to increase its control over its environment. In every society, technology determines "what is done" and "how it is done". There exists parallel to it a body of knowledge and ideas whose function is essentially explanatory; this includes religion, superstitions, and what can be called scientific information. This latter appears, although in very rudimentary form, even in the early stages of civilization.

The technology of primitive societies has two distinguishing characteristics. First, it is a simple technology in which practically everyone shares, and its tools, with rare exceptions, are made and used by members of the same community. In this sense, technology is an integral part of culture, both individual and collective. Secondly it is a non-scientific technology: it develops empirically with no reference to the body of explanatory information.

This separation between science and technology – which is evident also in the divorce between manual and intellectual work – persisted almost unchanged until well along in the Industrial Revolution, which began in England in the 18th century. For purposes of our analysis, the most important aspect of this process is that it began through the use of technology which was basically "pre-scientific", which was quite unrelated to the scientific revolution which had started more than a century earlier. Its machines and tools were created by imaginative artisans, on the basis of empirical knowledge accumulated slowly over many generations.

The Industrial Revolution was sparked by essentially socio-political factors which are too well known to need any detailed review. The key elements were the revolution in agriculture, which drove rural workers to the towns, and the creation – as a result of increased commercial activity (encouraged by maritime power and colonial expansion, and intensive cultivation of the land by a small group of business-minded property owners – of a rich bourgeoisie, which, when it gained political power, used its new values as a guide and destroyed the last vestiges of the medieval mentality and social organization.

It was only at a relatively advanced stage of the Industrial Revolution that technology based on science gradually became the driving force of industrial progress, first in the chemical industry, and then through the application of some basic discoveries, such as the use of electricity to generate energy. As a consequence, even though the Scientific Revolution made possible the rapid rise of the Industrial Revolution, it probably would not have produced it had there not existed certain socio-economic factors which made possible the use of the products of scientific creativity for the ends of social progress. Without the technological demands of the productive system, western science would probably have evolved much more slowly or been totally paralysed, as happened in Alexandrian Greece or in Ancient China. Moreover, although scientific technology has steadily progressed since its beginnings in the second stage of the Industrial Revolution, it was only during and after the Second World War that the scientific and technological system became a central preoccupation of governments, especially in the industrialized countries. To sum up – and this is the most important conclusion to be drawn from this historical evolution – *the progress of modern science has always been linked to the existence of an effective social demand for its practical applications.*

On the other hand, scientific technology has produced a phenomenon which has to a large extent determined the character of the modern world. The creation of technology has ceased to be an activity in which almost all human groupings participate – as was the case throughout most of history – and become the privilege of a small group of industrialized nations. For the countries of the Third World, technology has become an exogenous factor; when they import or copy indiscriminately the technologies of the developed countries, they also import a particular culture, – customs, attitudes, values, etc. – since the former are inseparable from, and to a large extent conditioned by, the latter.

The subordinate position of the countries of the Third World in the creation of science and technology can be explained only in part by its high cost. This is shown by the fact that – in relative terms – these countries devote much less effort to scientific activity than do the developed countries, thus reflecting the low priority which they give to it. The causes for this scientific backwardness must be sought, not so much in material limitations, as in the socio-political factors which are at the very root of under-development. This is the case at least of Latin America, which we shall now examine briefly.

SCIENCE, SOCIETY AND IDEOLOGY IN LATIN AMERICA

We shall look first at the characteristics of the scientific systems of this region, to see how they differ from those in the industrialized countries.

a) Dimension: The scientific systems of Latin America are very small in comparison with those of the developed countries, in both absolute and relative terms. Its countries (with the exception of Cuba) devote between 0.1 and 0.2 per cent of their GNP to RD (Research and Development), while the advanced countries devote between 1 and 3 per cent.

b) Internal structure: In the developed countries the ratio between the funds devoted to basic research and those used for applied research and development varies between 1 to 9 and 1 to 4. In the Latin American countries, on the other hand, the proportion devoted to basic research is much greater: the ratio probably varies between 4 to 6 and 6 to 4. Also, and again in contrast to the advanced countries, there is practically no functional relationship between the three sub-systems of the scientific production structure (basic research, applied research, and development).

c) Direction of the research: The greater part of the scientific research carried on in the region has very little to do with its fundamental problems; it is oriented rather around those subjects which are predominant in the more advanced countries. This is perhaps the most significant characteristic of the scientific systems of the developing countries.

d) Decision-making processes: Using systems terminology, we can say that the scientific systems of the advanced

countries are open as far as basic decisions on the orientation and objectives of research are concerned, and closed when it comes to decisions on organization and internal functioning. In other words, the direction of the research is determined essentially by the demands of society, expressed through various mechanisms, either implicit or explicit, while responsibility for everything which has to do with its internal organization – the appointment of personnel, criteria for hierarchical grading, etc. – is left to those who are part of the system, with very little interference from outside. In the Latin American countries, the situation is the reverse: the subjects and general orientation of the research are determined by those within the system, with practically no interference from the rest of the society, while the government authorities continually intervene in the internal decision-making processes related to organization, especially the appointment of personnel and for hierarchical grading criteria.

SCIENCE AND TECHNOLOGY IN THE HISTORICAL DEVELOPMENT OF LATIN AMERICA

An overall view of the historical development of Latin America is essential to an understanding of the role played in the society by science and technology. The relationship between science and ideology in the government sectors – which we shall deal with first – can be deduced only from the way they have acted throughout history, since officially this relationship does not seem to differ greatly from that in the more advanced countries.

In what follows we shall describe briefly what we believe to be the reasons for the marginal role which science has had, and still has, in the evolution of Latin America. This will necessarily be given in very summary form, and some of the statements made really require more detailed development.

We have seen that, in the history of the West, science has progressed only in response to an *explicit* social demand which finds expression through mechanisms which act effectively in either a direct or indirect manner. The core of our argument will be that the real scientific policy of a country is determined by the demands of the prevailing "national project".

By "national project" is meant the ensemble of a country's objectives, the model which it has set for itself, the goal of all those social classes or sectors which, directly or indirectly, control its economic and political life. Clearly this concept has nothing to do with what is sometimes described vaguely as "national aspirations", which are supposed to represent the needs of the whole, or the larger part, of society.

The national projects of the majority of Latin American countries originated in the colonial period and were consolidated in the 19th century after the wars of independence. They have produced peripheral economies, dependent on the international power structure, exporting primary materials and importing the manufactured products of the great industrialized powers. The stability of these projects is based on an alliance between the local beneficiaries – the hierarchy of landowners, exporters and importers – and the centres of world power. They are organized around extensive cultivation of the land, the production of some very primary consumer goods, and the exploitation of raw materials for foreign capital, and therefore generate little demand for local research and development. As a result, the only disciplines which are cultivated are those which are necessary for "maintenance" work, e.g. medicine, engineering in the purely professional sense, etc. Genuine scientific research is a cultural luxury available only to those individuals or small isolated groups which are financially independent or which secure the sporadic protection of some power group. The small amount of research which is thus carried on is related to those few disciplines for which there is some effective social demand – medicine, for example – or develops precariously in almost total isolation from the local situation, and under the influence of the great foreign scientific centres.

This type of national project prevailed, almost unchanged, until the beginning of this century. The society was strongly polarized, with the ruling, predominantly urban, class exercising almost total control over vast land areas inhabited by illiterate peasants.

The changes which occurred in the international situation in the first decades of this century had a profound effect on the countries of Latin America. Prominent among these were the Great Depression, which cut back considerably the demand for raw material, the world wars which greatly reduced the export of manufactured goods from the developing countries, and the deterioration in the prices of raw materials as compared with those of manufactured goods. These external factors were accompanied by new or accentuated internal developments which also helped to change the conditions encouraged by the existing national projects. The most important of these were the demographic explosion; the growth of a middle class as a result of the beginnings of industrialization and the expansion of the service industries and the government bureaucracy; the rapid growth of an industrial proletariat; accelerated urbanization, and the extension of elementary education and the mass media.

The complex interaction of these internal and external factors forced change – in practice if not in principle – in the prevailing national projects. Thus began a process of industrialization whose products were to replace those imported from abroad. In a parallel process, the growing middle class gained access to political power, at different times and under varying circumstances in each country. This social class has sometimes been compared with that which served as the driving force of the Industrial Revolution in Europe, but there is little justification for this parallel. The political ideology – liberal, free-trade, anti-clerical – which was in general characteristic of this European middle class reached the Latin American urban middle class much before the beginning of industrialization. Therefore, this class did not represent the interests of the manufacturers, because these were not sufficiently important nor organized to constitute a real centre of power on the national scene. Industrialization was born, not as the project of a reformist middle class determined to impose its own values, but rather primarily as a result of factors external to the region.

On the other hand, the total implementation of a new national project based on industrialization would have been possible only through profound changes in the social, economic, and political structure of these countries. Given the inherent weakness of the middle class, which either held or shared political power in a precarious equilibrium with the traditional classes which still controlled the principal centres of economic power, such reforms would have required an alliance with the popular classes – the rural and industrial proletariat – and their participation in political power. Faced with this alternative, and fearful of unleashing a process which they were not sure they could control, the rising middle class preferred to introduce essentially political reforms which, rather than making any radical changes in the system, permitted them to share power with the old oligarchies.

The changes made in the national projects called in the beginning for very little local research. Industrialization began with the manufacturing of those goods which were easiest to produce. Technologies were imported in rapid succession. However, as the process advanced, increasingly complex goods had to be produced; for these the technologies changed rapidly on the basis of research and development in the advanced countries. Under these conditions, the inability of the local scientific and technological systems to carry on basic research, or even to make intelligent adaptations of what had been done elsewhere, led to a decrease in the relative productivity of industry, the elimination of its products from the market, etc. In the field of agriculture, the low productivity, due in large measure to technological backwardness, which in turn was the result of the land-holding system, became increasingly serious in light of the mounting demand for food and raw materials of the growing population.

Even though the changes made in the old national projects did not alter their essential features, they did require a sum total of science and technology much greater than had the original set up. Therefore a system of research and development capable of providing the necessary dynamic for the productive machinery had to be created.

From the very beginning, the organization of this system came up against many very diverse and complex problems which could be summed up as follows. In the first place, as we have already seen, the Latin American middle class came to power without any national project which provided a real conceptual alternative to the traditional project then in operation. Moreover, there has been little change in the structures on which the power of the old dominant groups was based: they continue to set the guidelines for national policy, either directly or through the ideological and cultural influence which they exercise on a large part of the middle class, including the emerging industrial bourgeoisie. Clearly this governing elite, because of its cultural formation and the way it sees its own interests, has neither the ability nor the will to create a relatively efficient research and development system. They have been trained to visualize a development model which makes few demands on technology and which considers scientific activity as a cultural luxury within reach of only richer and more advanced societies. Therefore the idea of science as an instrument, as a tool of change, clashes head on with firmly established prejudices and thought patterns.

In addition, the dominant class does not aim to create research and development systems which would give genuine scientific autonomy to the countries of the region, since this is not only unnecessary but would also be dangerous for the national projects which they want to perpetuate. Their objective is rather to create a scientific-technological machine which confines itself to meeting the limited needs of the system without questioning its basic structure. It soon became clear that this objective is very difficult to attain in the particular circumstances of Latin America. The more or less autonomous scientific centres, especially the universities, have rapidly become dangerous nuclei for discussion which casts doubts on the fundamental values of the prevailing order. The powers that be, which cannot tolerate any serious questioning of the basis of the system, try to neutralize such criticism through a repressive apparatus: obstacles to free expression of ideas, ideological persecution, the selection of professors on the basis fo their respect for the regime rather than their intellectual capacities, etc. As a result, the scientific structure, subjected to a regime which stifles intellectual creativity, has deteriorated to the point where it is incapable of satisfying even the limited demands of an essentially static system whose only aim is to hold on to what it has.

This relationship between science and society in Latin America accounts for the nature of its scientific systems as outlined earlier. The predominance of basic research and the lack of any connection between the sub-systems, and between the subjects of research and the basic problems of the region, result from the fact that, because of the nature of the majority of national projects, society has made no effective explicit demands on the scientific systems. This also explains the closed character of these systems when it comes to decisions on lines and subjects of research, and the openness of their internal control. In fact, the lack of any explicit social demand means that the researchers must decide for themselves what they will do; in general they choose those subjects which are most relevant in the international field. The reason for this is very clear: the international scientific community has a system of incentives and rewards – intellectual prestige, the possibility of being invited to work in more advanced research centres, etc. – which are attributed primarily to those working on "fashionable" subjects. As for the scientists pursuing subjects of local interest – normally less attractive from this point of view – the only reward they can hope for is the satisfaction of knowing that they are useful to their own communities.

The continued intervention of power groups in the internal organization of science is also easily explained: it is the only way they can exercise political and ideological control over the scientific and technological system and thus prevent it from becoming a dangerous centre for the discussion of the basic assumptions of the regime.

SCIENCE AND IDEOLOGY IN THE RULING CLASSES

The role played by science in the ideology of the ruling classes of the area is also clear from the above. On the one hand, their essentially European education and cultural traditions have given them the intellectual respect for science which is characteristic of what we call Western culture; they recognize scientific knowledge – and even more scientific facts – as an important part of education, along with literature and art, although of lesser relevance. On the other, they consider scientific production and especially its related technologies, as belonging specifically and exclusively to the more advanced countries. They consume imported scientific and technological know-how in the same way as they consume manufactured goods. They have no confidence in local science as an instrument for change and transformation, just as they reject progressive ideologies, although, curiously enough, in the latter case on the grounds that they are "imported" and foreign to "national sentiment". In short, this ambiguous evaluation of science arises out of their position in a structure of international dependence of which they are the beneficiaries.

In the last ten or fifteen years, some changes have begun to appear in the composition and attitudes of the ruling classes. In some of the more advanced countries, the industrial bourgeoisie have increased their political power at the expense of the old landholding oligarchies. The most significant ideological manifestation of this has been what is known as "developmentalism".

This tendency puts the emphasis on industrialization, beginning with the development of heavy industry (iron and steel, petrochemical, etc.). It assumes that an accelerated process of industrialization will expand the "modern" sector of the economy until it embraces the whole of society; industry thus becomes the panacea which in itself will resolve all the problems of underdevelopment. In a certain sense this is somewhat of a caricature of the liberalism which accompanied the Industrial Revolution of the last century, although devoid of the ideals of political and ideological liberty which characterized the best European forms of this process, and in a completely different historical context.

In the developmentalist ideology also, science plays a secondary role. There is a massive importation of technology together with foreign capital. Science, as a part of culture and the autonomous self-expression of a people, is considered, along with education, as merely an element of the superstructure which will also in the end be modified by the advance of industrialization. The present Brazilian process is the best example of the thoroughgoing application of this kind of development.

To complete this brief outline, we shall analyse the role of science in the ideology of the political currents of the Left which, with their varying ability to mobilize the people, are trying to contest the power of the old dominant classes. We can set out here only a few very general ideas of an exploratory nature, on a theme which has received very little attention until now.

There is a wide range of Leftist political trends in Latin America, from the communist parties which in general follow the orthodox soviet line to the groups of the so-called "national left" which represent an amalgam of nationalistic positions, held together by a radical philosophy of social change. Within this spectrum there are also various ideas of how power is to be gained, all the way from peaceful elections to urban and rural guerrilla warfare.

The position which these movements take towards science cannot be easily deduced from their ideological declarations and action programmes: preoccupied with the immediate problems of the struggle for power and survival, they give little attention to subjects which they consider of only long-run relevance. Nevertheless, some conclusions can be drawn from their more general basic theories.

In the first place, and certainly as an outgrowth of Marxist principles which are shared to a greater or lesser degree by almost all these tendencies, science occupies an important place as an instrument for the transformation of society, especially because of its ability to create technology for the system of production. Moreover, they consider the scientific system as a superstructure whose form and orientation are completely dependent upon how power is distributed within the society. Once the social revolution has occurred, the scientttific systems will naturally be adapted to the new objectives and values of the community. Therefore, although they believe that the scientific enterprise will have to be planned, in the same way as the economy, they do not consider the study of the scientific system itself and of its values as of real practical interest.

As for the technology to be used, they believe that, especially in the early stages of the process of change, the types produced by the advanced countries will be sufficient to satisfy the needs of the new society. The underlying assumption is that technologies are essentially neutral, and that the alienating character of those which have been imported is entirely the result of the use to which they have been put by the social classes which hold power.

In our opinion, this view of the problem of science in the underdeveloped countries does not take sufficiently into account that technology, in the anthropological sense, is one of the elements which is most determinative of cultural forms. As already pointed out, to import technologies means in large measure to import the attitudes, customs, and values of the countries which produce them. Even though the processes of change are successful in the political realm, their ultimate objective – to build a new society based on its own values – is frustrated. The new social project, unable to find its own specific forms of expression, will end up adopting, along with technology, many of the values and structures which it claims to reject.

THE IMPACT OF SCIENCE AND TECHNOLOGY ON THE THEOLOGICAL UNDERSTANDING OF SOCIAL JUSTICE

by Roger L. Shinn

The big news, so far as social justice is concerned, comes from the interactions of two momentous historical movements. The first is the social revolution or series of social revolutions in many places with many styles and tempos, sometimes successful and sometimes frustrated, but never long forgotten. The second is the technological revolution that stirs life in every section of this globe.

The two operate in intricate ways through changing modes of production and consumption, radical revision of life styles, international wars (cold and hot), racial and class struggles, ideological conflicts, movements of liberation and repression. They produce such opposite effects as simultaneous rising expections and rising starvation. They have brought the world to a point where it is common to say, as Arnold Toynbee and many another have said, that the human race is in greater danger than at any time since man first won a precarious security against the depradations of wild beasts and climate.

These two revolutionary movements affect the very meaning of social justice, certainly for Christians. It is possible, of course, to disagree. Conceivably justice might be a fixed concept, an eternal ideal. Its application to changing circumstances would then require variations of detail, but would not affect the fundamental concept or allow for surprises. But Christians believe in a God who is capable of surprises. Although he is dependable, not capricious, he leads his people into a future that does not derive solely from a past. Although he has made known his justice to past generations, he is able to show new possibilities and new meanings of justice in new eras.

Therefore, the church has a responsibility to examine the history in which it lives and to ask what justice means in our time. Without assuming that all historical actions are God's doing, the church looks for the activity of God in history. It looks for new human possibilities, for new meanings of faithfulness, for new evidences of the demands of justice and the opportunities for love.

Mankind is not fully prepared for its present crises, and the church shares in the world's bewilderment. It should not expect to be spared from anguish and perplexity. But it has some resources for meeting some challenges. In talk about social justice, the church is on familiar – though not necessarily comfortable – soil. When the subject is technology, the terrain is more strange.

This is not to say that the church always welcomes discussion of social justice. It is even less to say that the church always acts for social justice. Churchmen may, in lethargy or in retreat from the public arena, neglect the demands of justice. They may, in defensiveness of privilege, resist those demands. They may, in ideological self-interest, invoke religion on the side of injustice. Nevertheless advocates of justice stand in a long biblical and historical heritage. Christians believe, whether to their inspiration or to their discomfort, that God is just and that God wills justice for his people. Christians know that they are called to act for justice and to recognize and speak to injustice.

With technology the story is different. Although humankind has always been a technological species *(homo faber),* although the discovery of the wheel and the lever go far back into pre-history, the technologies that shape contemporary life are recent. Perhaps, as has often been argued, biblical faith has something to do with the encouragement of science and technology. But the Bible and most of Christian history preceded the modern explosions of technology. Scripture and doctrine do not address technology in the way that they address social justice. It is not evident that Christians have any special competence in matters technological.

Thus when the World Council of Churches convened the Geneva Conference of 1966 on the theme, "Christians in the Technical and Social Revolutions of Our Time", it was the social rather than the technical revolutions that got the major attention and that led to the most dramatic encounters. Parts of the program emphasized technological change, and almost everyone understood that technology meant increased power for those who controlled it. But the few skilled technologists present reminded the conference that they were a little lonely in the Geneva crowd, as compared with their clout in the world at large. The conference got the point, and it urged the World Council to take up a study of technology in its relation to human values and social structures.

Since 1966 the World Council has been doing that. Initially there were some objections. Might not attention to technology be a diversion from the more pressing issues of social justice? Was the technological concern a ruse of the powerful nations and classes, who would rather talk about it than about the distribution of power in an unjust world? Was it a cop-out of tired liberals who wanted a less controversial issue than war and race? In 1966 – that recently – few in the World Council realized that the issues of technology were about to cast old issues of social justice into more dramatic form than ever before.

1. Social Justice in Relation to Population and Resources

One of the delegates to Geneva in 1966, economist Kenneth Boulding, had already been insisting that mankind could not continue its reckless destruction of the planet that is its only home. The earth, he said, is finite and fragile. It once seemed so huge that people could exploit its resources and pollute its atmosphere and waters heedlessly. Now mankind must learn again its dependence on its environment. We must shift from an ethic of plunder to an ethic of parsimony. We must see the earth as a beautiful and delicate space-ship, whose inhabitants must learn to husband and recycle precious resources. Boulding went so far as to propose that the Sermon on the Mount, long regarded as only an eschatological ethic for any Christians except the most dedicated monastics or sectarians, might become a necessary model for human life [1].

Boulding's theme was premature for most delegates at Geneva, but it soon won major attention in one or another diverse formulations. By the Nemi Conference of 1971 the message was inescapable: mankind cannot count on continuation of its recent spectacular increases in population, production, and consumption.

This chapter need not repeat the discussion in Chapter 1 above. The present purpose is simply to show how the issue affects action for social justice. That purpose will require a quick review of the way the debates shaped up.

The Nemi conference faced the issue in a paper by British economist E.F. Schumacher. He stated that the past 25 years, in which the economy of the Western world has run "at full speed, in fact at continuous acceleration," was unprecedented in human history and probably unrepeatable. A result, he argued, was "more miserable people in the world today than there were 25 years ago: more in absolute numbers and a higher proportion."

The theme was reinforced in an address by Jorgen Randers, one of the co-authors of *The Limits to Growth* [2], at that time yet to be published. Randers was part of the team at the Massachusetts Institute of Technology, working on the now famous research project sponsored by the Club of Rome. He argued that unchecked expansion of population and production would lead to catastrophe.

Not everyone was convinced by the reasoning of Schumacher and Randers, and the argument over the possibilities of economic growth has now become one of the major issues of intellectual debate throughout the world. Schumacher and Randers did not themselves agree entirely, and at the Cardiff conference in 1972 Schumacher made a slashing attack on the "worthless prescriptions" of the Club of Rome study [3]. To some observers this intramural argument seemed strange, since both parties agreed in rejecting the technological aspirations that have captivated so much of the world.

The conflict is in a difference of ethos. Schumacher is a Quaker, who looks at the human effects of technology and calls for new models of society based on people. In his address at the North American-European Conference at Pont-à-Mousson in 1973, he asked for intermediate technologies based on four criteria: smallness, reduced capital-intensity in favor of labor-intensity, simplicity, and nonviolence toward people and nature [4]. The title of his address, "Small is Beautiful", later became the title of a book, to which Theodore Roszak wrote an introduction [5]. Roszak at Nemi and in his own books [6] has been an enthusiast for the counter-culture. By contrast, Randers, sponsored by the Club of Rome and working at the Massachusetts Institute of Technology, appeared as a representative of the citadel of the technological establishment (even though Randers himself showed great human sensitivities). And the computer-model used in *The Limits to Growth* appeared to embody the fascination with quantification that the counter-culture abhors. So the makings of a debate are present in the two positions.

Nevertheless, the agreements are striking. They are, in fact, the more impressive precisely because Schumacher and Roszak, with their human sensitivities, and the Club of Rome study, with its quantified studies, agree so emphatically in rejecting the pattern of growth on which most of the world has staked high hopes.

It is the questioning of those hopes that poses a major issue for social justice. To many representatives of the developing countries, the attack on the possibility of continued growth in production came like a thunderclap of doom. One Asian said, "I am almost tempted to say that, even if it is true, it should not be said" – so devastating did he find the consequences for his own society. Some Latin Americans and Africans wondered whether the whole idea was a plot of the affluent societies to deny to developing countries the gains that their exploiters had already won. It made little difference that Schumacher was himself devising intermediate technologies for developing countries or that Randers advocated a tripling of production in the poorest parts of the world and a reduction in the richest. The white West has little credibility in Asia, Africa, and Latin America; and the assurances and good will of individuals give little reason to believe that their proposals will become effective.

A comparable distrust has long affected international discussions of the population problem. At Geneva in 1966 a typical debate was often repeated, whether in formal meetings or in corridor conversations. The subject was the desperate poverty of much of the world. Usually a white Westerner volunteered the idea that there was no solution for poverty without restraint in population. Usually somebody from the developing world answered that the problem was not population but exploitation and injustice. The new realization of the finitude of resources has intensified both sides of the argument. Those concerned about population say, with increased emphasis, that despite all the contributions of the green revolution and of technological development, the earth simply cannot feed and maintain a population doubling every 35 years. Others reply that it is the wealthy countries with relatively stable populations that devastate the earth through consumption and pollution, far more than the highly populated, low-consuming countries. They may add that the United States of America, with six per cent of the world's population, consumes about 40 per cent of its material goods.

That such arguments have not led to an impasse is something of a triumph for the ecumenical spirit and for the recognition of a factual situation. Since 1966 the antagonisms on the population problem, which might have become worse, have actually moderated, at least within the World Council of Churches. As trust has increased, Christians from affluent countries have become more ready to acknowledge the problems of exploitation and oppression; and Christians from countries with burgeoning populations have become more aware of the demographic burden. (See Chapter 3 above).

The upshot of these years of discussion since 1966 has been the growing realization that concern for the world's resources, far from diverting attention from social justice, heightens the issues of justice. Ecology, sometimes thought of as a hobby of the wealthy and comfortable, turns out to be even more critical for the poor. The rich do not starve; the poor are starving daily. The rich ride out the rising prices due to exhaustion of resources; the poor restrict consumption. The rich in air-conditioned suburban comfort protect themselves from pollution; the poor live downwind and downstream from polluting industries.

Furthermore, the new awareness of the earth's finitude destroys some of the easy but fallacious answers to injustice. Most of the literature – Christian and secular – on poverty prior to 1965 assumes that economic growth can overcome poverty. There are two kinds of reasoning. The first is that, when the economic pie is growing at a spectacular rate, even the poorest get a steadily increasing slice. The second is that, even if the pie must be resliced, nobody need give up anything; the rich, by growing more slowly, can enable the poor go grow more quickly. Both within the affluent societies (notably the U.S.A.) and internationally the assumption was that the "war on poverty" would be financed from the "growth dividend".

Once the growth dividend is thrown into question, the reasoning must change. Justice can no longer be achieved by a spill-over of prosperity. As in biblical ethics, justice means sharing – both of goods and of power.

It may be inconceivable that the wealthy nations will voluntarily share. Under the pressures of scarcity they are likely to grasp even more desperately what they have. But history itself requires some change. There are signs that scarcity is modifying the old bargaining advantage of industrialized countries, who paid low prices for raw materials and sold industrial products at high prices. An economic tilt is taking place, to the advantage of the producers of raw materials. That, of itself, does not always produce justice. In its most conspicuous example thus far, it has worked to the economic disadvantage of industrialized nations that consume petroleum and to the advantage of developing countries that produce petroleum. But it has worked the greatest hardship on developing countries of Asia and Africa that must import petroleum.

Obviously neither nature nor impersonal history is going to do the difficult work of achieving justice, even though nature and history may hasten the end of some specific injustices. The achievement of justice remains a *human*

responsibility. The historical record gives little reason to expect great success. But the calling to witness to and act for justice remains clear.

2. Social Justice in Relation to Technological Power

Technology is a means by which people increase their power. In some ways this enhancement of power is humanly good: people use technological power to produce food, to overcome disease, to make decisions about their lives and futures. In other ways the enhancement of power is harmful: people use power to control other people, sometimes to destroy.

Charles West has interpreted the Geneva Conference of 1966 as a confrontation between two movements, which he calls technological humanism and revolutionary humanism [7]. The first asks what technological changes can improve the human situation by increasing the power of mankind to cope with its problems. The second asks what social changes can transfer power from oppressors to oppressed. Increasingly in the years since 1966 the two questions have converged.

The green revolution, for example, has increased the human ability to ward off starvation; it has also magnified the power of the rich over the poor in some places. Revolutions in communication mean that news spreads rapidly around the globe; it also means that those who control networks of communications have a special ability to influence events. The nuclear revolution may enable civilization to survive the exhaustion of fossil fuels; it increases the power gap between nuclear and non-nuclear nations. And, most frightening of all, it may offer the means for the violent destruction of civilization, perhaps even of mankind.

The history of technology is interwoven with the history of war. Many a technological advance, like nuclear fission and fusion, came about explicitly in the quest for more powerful weapons. Other technological advances, like the airplane, were quickly put to military use. Hence the assessment and employment of technology requires attention to human violence and warfare.

The Central Committee of the World Council of Churches, meeting in Addis Ababa in 1971, asked the Department of Church and Society to undertake a two-year study on the place of violence and non-violence in the struggle for social justice. The origins of this request were not primarily the studies on technology, which were already under way. They were the Martin Luther Kind resolution of the Uppsala Assembly (1968) and the financial support from the World Council (beginning in 1970) to liberation movements combatting racism. Therefore the study on violence was concurrent to, not part of, the study on technology. Yet the two studies, in the nature of the case, interacted. Violence and warfare are old stories; but the scope of violence in technological warfare is a new story. Two cases in point are especially important.

(1) Nuclear warfare, it is often argued, cannot possibly meet the traditional criteria of "the just (or justifiable) war". One of those criteria is proportionality: the gain sought must be greater than the damage done. Another is distinction between combatants and noncombatants. Nuclear warfare, in its overwhelming destructiveness, violates both criteria. Hence traditional justifications of warfare as the lesser evil or as a tragic necessity for the sake of justice can no longer be invoked for this kind of warfare.

(2) It is sometimes said that a doctrine of "just revolution" is more appropriate to the present world than a doctrine of "just war". Technology, however, changes the nature of revolutions. It is pretty hard to mount an old-fashioned revolution against an oppressive regime with concentrated resources of weaponry and surveillance. The revolutions that succeed are likely to involve guerrilla warfare. And in guerrilla warfare, it is often argued, the traditional distinction between combatants and noncombatants quickly erodes.

In these two ways, then, violence in a technological age becomes morally more dubious than in the past. At the same time, some conventional distinctions between violence and peace have become blurred. Peace may be the ideology of the comfortable, who see any challenge to their power as disruption of the peace [8]. Oppressed people see the violence – sometimes called systemic violence – that is, built into systems of oppression, whether in obviously brutal ways or in such sophisticated and effective ways that the exercise of open and overt violence is rarely necessary. Economic, political, and technological power can be so effective that their practitioners seldom need to invoke the military weapons that they usually have available.

People entered the study on violence and nonviolence with a variety of experiences and convictions. Some were pacifists, veterans of struggles for justice and advocates of continuing struggles, committed to the use of nonviolent methods. Some were conservatives, advocating the necessity for the state to enforce law. Some were liberals, favorable to peace and justice, not quite pacifist but concerned about the destructiveness of modern war. Some were participants in liberation movements, convinced that renunciation of violence meant withdrawal from the struggle for justice.

Such a group could not reach sweeping agreements. Yet the report to the Central Committee of the World Council of Churches [9] did come to some agreements. It renounced some forms of violence – the violence of oppression, whatever the means; and the violence of torture, whatever the goal. It asked for greater attention to the methods and techniques of nonviolent struggle for justice. It reminded all Christians of the ambiguities in their actions, whether violent or nonviolent, yet called on them all to act for liberation, justice, and peace.

Other aspects of technological power in relation to justice come to a focus in issues of nationalism and self-determination. One of the major continuing debates at Geneva in 1966 began in a turmoil of semantic confusion. The key word was nationalism. To West Europeans and North Americans, nationalism was demonic. They had seen its worst consequences in World War II, and they saw its threats in an age that required internationalism. They were sometimes astounded at the affirmations of nationalism from other parts of the world, especially from Africa. To some of the Africans nationalism meant, first, freedom from colonial domination and, second, transcendence of tribal disunities.

After a few days of misunderstanding, debaters came to realize that both the denunciation and the praise of nationalism had, *in part,* the same purposes. All agreed in rejecting the predatory nationalism that fomented international wars and exploited other peoples. All agreed in endorsing freedom and self-determination for past victims of colonialism. But some arguments remained. To the opponents of nationalism, the eloquent nationalists seemed to advocate a value that has become obsolete in this dangerous and interdependent world. To those who esteemed nationalism, their critics seemed to be denying young nations the rights that old nations had long enjoyed.

The differences are understandable. If an American (i.e., from the U.S.A.) calls for some qualifications of national sovereignty in economic and military matters, he is still pretty sure that his nation will have a lot to say about the resultant situation. An African, hearing the same words, suspects that his nation will not have a lot to say and will, in

The debate has continued in recent years. Already at Geneva, despite the dominant emphasis on the responsibility of the developed societies to increase their economic support to the developing countries, there were frequent reminders that foreign aid sometimes does more harm than good. By the Uppsala Assembly, the criticisms and sometimes even renunciations of foreign aid were stronger. Self-reliance became a prominent concept in the Report of the Conference on the Scientific, Technological and Social Revolutions in Asian Perspective, at Kuala Lumpur, Malaysia, in 1973 [10]. African participants in WCC deliberations increasingly used the word.

The accent on self-reliance raised social and theological questions. It expressed deep disillusion with patterns of international cooperation that combined idealistic rhetoric with unjust exploitation and perpetuation of old forms of dependence. But how much self-reliance is possible in a world that is technologically interdependent? And what kinds of self-reliance are compatible with the Christian conviction of a common humanity under God? Is there a false bravado in claims to self-sufficiency – whether uttered by President Nixon as a goal of an energy program or expressed by people long dominated from outside?

To such questions the advocates of self-reliance usually reply that they are quite ready to affirm *interdependance* if it is genuine. They cannot advocate interdependence if, in fact, it means the dominance of some and the dependence of others. Such a position is ethically convincing. What remain to be discussed are many issues involved in interdependence. How can a world preserve a variety of cultural traditions while sharing a largely common technology? How can reckless national sovereignty be curbed without depriving people of basic human rights? How can local and regional self-determination be related to global needs? How can ecologically destructive practices be stopped without dangerously coercive centralized control? What is the relation between healthy self-reliance and awareness of the mutual needs of all for one another? How can particular groups determine their own destinies in relation to the destinies that all society shares?

Such questions loom large on the agenda of the churches and of mankind.

3. Justice in Relation to Biological Technologies

New technologies touch human sensitivities with special force when they impinge directly on persons, as biological and medical technology do. Here the impact on human mind, body, and spirit is immediate and obvious. Here technology affects not only the circumstances of life but also the meaning of selfhood in its most intimate aspects.

The Working Committee on Church and Society, deciding at the Nemi meeting to undertake "a pilot study in some very specific areas of scientific activity which generate disturbing problems", selected genetics as such an area. Church and Society, therefore, in cooperation with the Christian Medical Commission convened a panel of some 30 specialists in Zurich in 1973. The participants included geneticists, biologists, physicians, lawyers, theologians, counsellors, and others. They brought experiences from Australia, Africa, Asia, Europe, and North America. Their findings have been published in a booklet, *Genetics and the Quality of Life*[11].

The group chose to concentrate, not on distant questions of projected genetic engineering but on procedures now actually in practice and increasingly the occasions for decisions by troubled human beings. Hence it examined especially two issues: genetic counseling, which may give warnings or reassurances to some persons who anticipate parenthood; and foetal diagnosis, which may lead to a decision to abort a defective foetus.

The ethical issues in genetics, like many issues related to new technologies, yet more dramatically than most, call for decisions for which there are no precedents. Christians have for centuries thought about social justice in relation to war, to political rights, to economics, to the brotherhood of man. They can make decisions against the background of a tradition that has thought and tested experientially certain answers. In the case of genetics, there is no such tradition. The prophets never spoke on the issues. The accumulated wisdom of the church is silent on these matters. There are profound ethical sensitivities from biblical faith that bear upon genetic decisions, but the decisions themselves move into unexplored territories.

The work of Church and Society has always involved major reliance upon a wide mix of people with different experiences and skills. A clerical ethic is not adequate for decisions involving new knowledge and specialized competence. Hence ethical explorations must involve people with scientific and technical knowledge; it must likewise involve people of diverse social backgrounds, who know how the work of technologists is likely to affect them and their constituencies. From the conversation among people of varied competences and experiences may come some clarification of new issues.

Many of the decisions made possible by recent findings in genetics require knowledge that can come only from a highly skilled biological scientist. Yet biological science does not, of itself, determine social justice. So old questions of human good re-emerge in new forms.

For example, suppose that husband and wife know – as they could not have known in the past – that there is a 25 per cent probability of their child having a serious genetic disease. Should they refrain from procreation? Should they practice foetal diagnosis, with the available option of aborting the foetus (after 18 to 20 weeks) if they discover the feared genetic disorder?

What is moral justification for abortion, particularly of an advance foetus? The parents' preference for a child of another sex? A relatively minor genetic defect? A major genetic defect? Or nothing at all?

What is the meaning of the sanctity of human life? Does this sacredness pertain to biological existence or to something else? Does it pertain only to the physically and mentally healthy?

Suppose parents, who are not diseased but discover that they are the carriers of a genetic disease, can be assured (by foetal diagnosis with the possibility of abortion) that they will not pass on this disease to their children, but that they may pass on the genetic trait that can produce the disease in future generations. What is their moral obligation?

How does the Christian concern for individual freedom relate to the good of society? Should some parents be forbidden to procreate, even if they want to do so? Similarly, how does traditional Christian concern for the weak relate to the good of a society that may prefer to do without the exceptionally weak?

What does it mean for social justice that some medical procedures are available only to the wealthy? What does it mean that a procedure that can easily be instituted in some societies is almost totally unavailable in others?

Is there a threat to selfhood in moving the processes of procreation, at least in part, from the realm of marital intimacy to the laboratory? If quality controls, akin to those used in industry, are instituted over human reproduction, is something distinctively human lost? Or does human love find heightened expression in the prevention of unnecessary genetically induced suffering?

Christian faith and ethics have something to say on all such questions. But to most of them there is no one answer from the experience of the past. It is not likely that the Church will think itself able to issue moral decrees on such questions. What it can do is raise some questions before the onrush of technology takes directions without sufficient attention to some deeply human concerns. It can bring into the conversation the insights of people who often are not consulted. And it can add encouragement to the efforts of biological scientists to serve human needs.

In this area, as in many others, increased human powers mean increased human responsibilities. Social justice – the domain of responsible decision – has extended its scope to include many a question once outside its purview. In the past people could be easily forgiven for mistakes that they could not help. There was no injustice in doing wrongs that no human being knew enough to avoid. Now mankind has the privilege and obligation of accepting responsibility for hard decisions suddenly thrust into the realm of freedom.

4. Justice in Relation to Nature.

Social justice, as modern Christians have seen it, has human society as its sphere of operations. It is God's demand of human beings in their relations to each other. Modern Christianity has seldom known what to do with those scriptural motifs in which God's righteousness extends to nature, in which man's sin corrupts nature and God's salvation reconstitutes the natural order. The messianic prophecies looking to the transformation of nature were mysterious and perplexing. They might have some interest to poets, metaphysicians, and theologians who liked esoteric themes. God, it might be granted, had in some sense a concern for his whole creation. But social justice had a sharper focus; its concern was people.

Now it turns out, as so often in Christian history, that the irrelevant becomes the relevant. The modern world is discovering, with some suddenness, that social justice is impossible unless the society involved includes, in some sense, nature.

In biblical faith the human relation to nature is expressed in two relationships: dominion and stewardship. Modern Christians, especially in industrialized societies, have usually hailed the dominion and neglected the stewardship. They sometimes claimed credit for Christianity's desacralizing of nature, thus freeing mankind to dominate nature for human purposes. They sometimes rejoiced that the environment had become primarily a man-made artifact, instead of a naturally given surrounding.

But the celebration was premature. Lynn White, Jr., was the most conspicuous of those who turned the theological claim back against Christianity, blaming theology for doing what it had boasted of doing [12]. White recommended a recovery of Franciscan Christianity. Others proposed that the Benedictines, in their careful tending of the earth, offered a more helpful precedent. Almost nobody continued in the hard-nosed style of trying to conquer the earth for the sake of people.

The discussion of the relation of mankind to nature (or to the rest of nature) continues in this current ecumenical inquiry, and no unanimous conclusions can be expected. Charles Birch, the Chairman of the enterprise, advocates a process theology that emphasizes the importance of nature and the ethical obligations of man to nature. (See *Anticipation,* No. 16, March 1974). Thomas Derr puts more emphasis on the primacy of mankind. [13] But he does not think that mankind can be isolated from its natural home.

We can expect the theological debate to continue. Perhaps there will be a consensus that any Christian conception of the eco-system will assign mankind a unique status within God's creation. People have an ability for decision-making that gives them both a special privilege and a special responsibility within creation. They cannot morally exercise the privilege without the responsibility. They may use and enjoy nature, but not without gratitude to God and appreciation for his gifts in the natural environment. They cannot even be just to one another without practicing "justice" toward nature. Perhaps Christians will also see a providential irony in the fact that a triumphant technology, which once gave the illusion of a human capacity to dominate nature, has now driven mankind to a renewed appreciation of the finitude of the earth and all who inhabit it.

Social justice, understood in the wider context of sensitivity to God and all creation, may then contribute to the cultivation of new sensitivities and new styles of life. Margaret Mead, in spontaneous conversation in the U.S.A. Task Force related to the WCC inquiry, said this:

> *The Church can begin to point out so many of the things that we are neglecting that don't take energy, don't pollute, don't use up irreplaceable resources.*
> *Prayer does not use any artificial energy, it doesn't burn up any fossil fuel, it doesn't pollute. Neither does song, neither does love, neither does the dance, neither does an arrangement of space in which people can enjoy their relationship to each other without having things built of steel or something of the sort.* [14]

Worship, prayer, song, and dance have in the history of religions sometimes been a diversion from the hard work of social justice. That is wrong. But it is also wrong to concentrate on a cramped and isolated social justice, separated from its wider context of appreciation of God, mankind, and nature.

Technology is a human achievement. Hence, it is a human responsibility. It is for mankind to direct technology, not to be victimized by it. In the course of events, technology has come to remind mankind of what is not a human achievement, but a divine gift: life, this earth, the stirrings of the spirit that make this human race discontent with what is, the divine and human possibilities of heading and transformation. Within that context social justice becomes an awesome and joyful human task.

NOTES

[1] Kenneth Boulding, "The Wisdom of Man and the Wisdom of God", in *Human Values on the Spaceship Earth,* by Kenneth Boulding and Henry Clark (New York: National Council of the Churches of Christ in the U.S.A., 1966. Reprinted in *Anticipation,* No. 7, April, 1971).

[2] Donelly Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, *The Limits to Growth* (New York: Universe Books, 1972).

[3] E.F. Schumacher, "Implications of the Limits to Growth Debate – Small is Beautiful", *Anticipation,* No. 13, December, 1972.

[4] E.F. Schumacher, "Small is Beautiful", *Study Encounter,* Vol. IX, No. 4, 1973, pp. 1-4.

[5] E.F. Schumacher, *Small is Beautiful,* (New York: Harper and Row, 1974).

[6] Theodore Roszak, "Can Jack Get Out of His Box?", *Anticipation,* No. 9, October, 1971. Cf. *The Making of a Counter-Culture,* (Garden City, N.Y. Doubleday & Co., Inc., 1969) Also, *Where the Wasteland Ends* (Garden City, N.Y., Doubleday & Co., Inc., 1973).

[7] Charles C. West, *The Power to Be Human: Toward a Secular Theology* (New York: The Macmillian Co., 1971).

[8] The point is at least as old as Jeremiah, who heard the Lord criticize people for "saying 'Peace, peace,' when there is no peace" (Jer. 6:14). Karl Marx put the theme in a different context, and contemporary society is familiar with still further aspects of it.

[9] "Violence, Nonviolence and the Struggle for Social Justice", *The Ecumenical Review,* XXV, No. 4, October, 1973, pp. 3-19.

[10] *Anticipation,* No. 14, August, 1973.

[11] *Genetics and the Quality of Life, Study Encounter,* Vol. X, No. 1, 1974.

[12] Lynn White, Jr., "The Historical Roots of Our Ecological Crisis", *Science,* 155 (March 10, 1967). Reprinted in Lynn White, Jr., *Machina ex Deo,* (Cambridge, Mass.: M.I.T. Press, 1969). Cf. "Snake Nests and Icons", conversation between Lynn White, Jr. and David Gill, *Anticipation,* No. 10, Feb., 1972.

[13] Thomas S. Derr, *Ecology and Human Liberation: A Theological Critique of the Use and Abuse of Our Birthright,* (Geneva: World Student Christian Federation, 1973).

[14] J. Edward Carothers, Margaret Mead, Daniel D. McCracken, Roger L. Shinn, editors, *To Love or to Perish: The Technological Crisis and the Churches.* A Report of the U.S.A. Task Force on the Future of Mankind and the Role of the Churches in a World of Science-Based Technology (New York: Friendship Press, 1972), p. 125.

Brief History of the Five-Year Ecumenical Inquiry on
THE FUTURE OF MAN AND SOCIETY IN A WORLD OF SCIENCE-BASED TECHNOLOGY

August 1969 — At its meeting in *Canterbury,* England, the Central Committee of the WCC welcomes the proposal of *Church and Society* to launch an ecumenical study on "The Future of Man and Society in a World of Science-Based Technology". The discussion of this urgent theme emerged at the 1966 Conference on Church and Society and the Fourth Assembly of the WCC at Uppsala in 1968.

April 1970 — Publication of the first issue of *"Anticipation* – Christian Thought in Future Perspective", an occasional study bulletin, published four times a year. It contains reports and papers from the various meetings in connection with the inquiry as well as other material relevant to the themes of the study.

June/July 1970 — First international exploratory conference held in *Geneva* on the subject "Technology, Faith and the Future of Man", defining the major issues for consideration in the further study process.
A report by D.M. Gill entitled *"From Here to Where"* (Geneva, 1970) presents an evaluation on the basis of background papers and speeches contributed to the conference.

June 1971 — 30 scientists, invited to an enlarged Working Committee on Church and Society (Chairman: Prof. S.L. Parmar, India; Vice Chairman: Prof. C. Birch, Australia), meet in *Nemi,* Italy.
Three subjects are examined:
1) Science and the Quality of Life
(First discussion of the MIT Study on "The Limits to Growth").
2) Political and Economic Choices in a Technological Era.
3) Images of the Future.
(See report published in *Study Encounter,* Vol. VII, No. 3, 1971)

March 1972 — Regional West African Conference on the subject of "Science, Technology and the Future of Man and Society" held in *Accra,* Ghana, to review issues from an African perspective.
Selected papers from this meeting published in *The Ecumenical Review,* Vol. XXIV No. 3, July 1972.

June 1972 — *Church and Society* organizes WCC representation and participation in UN Conference on the Human Environment at *Stockholm,* Sweden.
(See report: *Anticipation,* No. 11, July 1972)

September 1972 — The debate on ecology and the "limits to growth" continued at a consultation held in *Cardiff,* Wales, on "Global Environment, Economic Growth and Social Justice". The working groups focus discussion on the search for an ethic of natural resource use and criteria to evaluate models of social change.
(Report: *Anticipation,* No. 13, December 1972).

April 1973 — 45 scientists, natural scientists and theologians from various Asian countries meet in *Kuala Lumpur,* Malaysia, to discuss the implications of the "Scientific, Technological, and Social Revolutions" seen in Asian perspective.
Report (in *Anticipation,* No. 14, August 1973) puts emphasis on the quest for a relevant technology and the need to mobilize indigenous talent and experience.

May 1973 — North American-European Conference at *Pont-à-Mousson,* France, on "The Technological Future of Industrialized Nations and the Quality of Life" seeks to define the ingredients of quality of life and to clarify the options in terms of just distribution of available resources, both nationally and internationally.
(Report and papers of the conference: *Anticipation,* No. 15, December 1973, and *Study Encounter,* Vol. IX, No. 4, 1973).

May 1973 — *Church and Society* publishes study by Dr. Thomas S. Derr, Professor of Religion at Smith College in the USA, on *"Ecology and Human Liberation:* A Theological Critique of the Use and Abuse of our Birthright" (Geneva 1973), a survey of different attitudes and assumptions within the environmental debate and a theological approach from the biblical tradition.

June 1973 — Specialized consultation in *Zurich,* Switzerland, on "Genetics and the Quality of Life" takes up issues raised by new and disturbing possibilities in science and technology. The need for the definition of ethical guidelines in order to make informed choices calls for an inter-disciplinary ecumenical discussion.
(Report: *Study Encounter,* Vol. X, No. 1, 1974).

June 1973 — Small Working Party on Science and Theology meets to follow up this dialogue, assessing the relation of theology to ethical decision-making and scientific rationality.
(Report: *Anticipation,* No. 16, March 1974).

July 1973 — Meeting in *Leuenberg,* Switzerland, of enlarged Working Committee on Church and Society prepares paper on population policy in view of the World Population Year 1974. In August 1973, the WCC Central Committee commends this statement entitled "Population Policy, Social Justice and the Quality of Life" *(Study Encounter,* Vol. IX, No. 4, 1973) as a call to the member churches for study, comment and suitable action.

February 1974 — Father Paul Verghese, Principal of the Syrian Orthodox Theological Seminary at Kottayam, Kerala, India, completes the manuscript of a book dealing with the ecological issues from an Asian and Orthodox perspective. His study entitled *"The Human Presence: Reflections on the Role of Humanity in an Evolving Universe"* is to be published shortly.

June/July 1974 — Concluding World Conference in *Bucharest,* Romania: "Science and Technology for Human Development: The Ambiguous Future – and the Christian Hope".

August 1974 — Results of the five-year inquiry on the "The Future of Man and Society in a World of Science-Based Technology" submitted to the WCC Central Committee meeting in *Berlin.*